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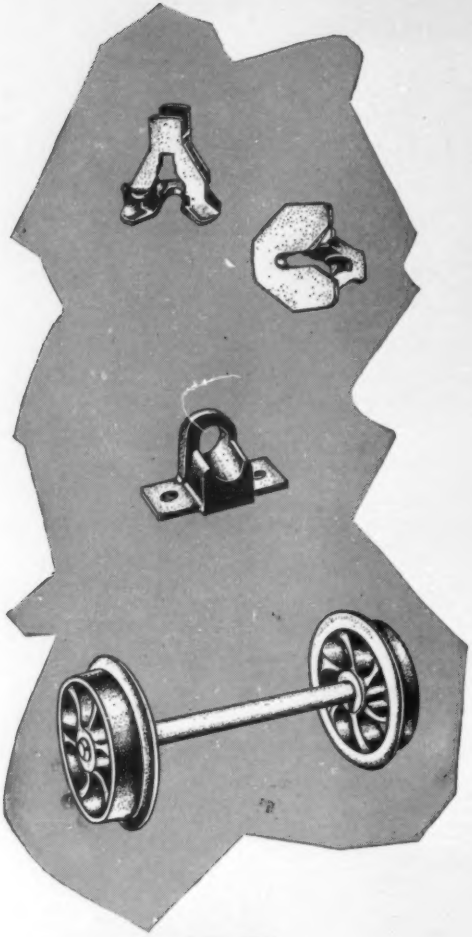

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IRON AND COAL
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Bank Chairmen

BANK chairmen have been able to look back on the year 1959 with special satisfaction. Their businesses and their profits have increased, and they can look forward to a further increase, though not to a corresponding growth of profits, when the House of Commons makes up its mind to permit payment of wages by cheque. Possibly wage-earners will agree to fortnightly or even monthly payments when they have bank accounts of their own. Mr. Tuke, at Barclays' meeting, suggested that the wage-earner should allow his wages to be "credited, in whole or in part, once a month by internal transfer to his banking account." But he expects the new habit to spread slowly.

Most chairmen could congratulate their shareholders on increased business and higher profits. Lord Monckton, at the Midland meeting, spoke of 42 new branches, an increase of one third in advances, and a 14 per cent. addition to the number of accounts. Of course, costs have increased too, and more sharply. Lord Aldenham, for the Westminster, expected "a continuous inflow of new account holders," especially from the approaching payment of wages by cheque. Whether the chairman expected a 5 per cent. Bank Rate on January 21 is uncertain, but it should mean an addition to profits unless customers reduce their overdrafts.

Chairmen treat the Radcliffe report with respect and general approval, although Lord Aldenham is glad "to find that the Government decided not to adopt all the recommendations of the committee." Lord Monckton regrets that the report was issued, and debated in Parliament, "before publication of the evidence on which it was based." He inclines to agree with the committee's view that "the quantity of money in existence" is not so important as "the liquidity of the economy," though he does not explain what the sentence means. Evidently he lays more weight on the volume of bank deposits, and the general use of cheques. Mr. Tuke regrets that the committee suggested that 60 per cent. of total deposits, or even more, could be used in advances to customers. With this suggestion the banks do not agree; Barclays has only recently reached "nearly 40 per cent." and would regard the committee's 60 per cent. as reducing the margin for investments to 10 per cent., a figure which would be "quite inadequate."

A bank has to make profits somewhere in order to cover its expenses, which have increased greatly in recent years; this it does mainly by lending to one set of customers the money deposited by another and larger set. Then there is a margin which can be invested in securities, but between the two figures is an amount which a bank must be ready to pay out on demand. Still, the banks have thought it worth while to be more generous or more trustful in the matter of "personal loans," which Lord Aldenham describes as "a welcome source of new business." Personal savings have increased, as indeed they ought to have done in view of the great increase in earned incomes, and the slight decrease in taxation. Foreign affairs have become more favourable with the trade agreements in Europe through the Common Market and the Free Trade Association. Lord Aldenham is certainly right in saying that one block would have been better than two; nevertheless, he reckons that "1959 has proved itself a good year." This was also Mr. D. J. Robarts's opinion at the National Provincial Bank, and he hopes that the Chancellor will announce further concessions to the taxpayer in April.

Certainly taxation at the present level in peacetime is a check on business activity. No chairman has suggested that income tax on salaries and wages may be passed on to the employer almost as certainly as higher prices are used by the trade unions to extract higher rates of pay. The old distinction between "direct taxes," which were supposed to stick where they fell, and "indirect taxes," which could be passed on to the consumer, has become blurred.

Industrial Relations

RELATIONS between employers and employed in the United States are apt to be more embittered than they are in this country. In Lloyds Bank Review, Mr. B. C. Roberts, Reader in Industrial Relations in the University of London, explains some of the differences in the industrial atmosphere on the two sides of the Atlantic, and looks for lessons which we may learn. In an article entitled "Industrial Relations in an Affluent Society," he assumes that we are already affluent, and shall go on raising our standard of living for the next 25 years. How much we may count on doing so depends largely on the avoidance of strikes, and on how far trade unions impose checks on management. Although the United States has the highest standard of living in the world, it has also one of the worst records of work stoppages.

The great steel strike of 1959 raised many ques-

tions, the chief being whether the country could stand so big an addition to wages without inflation. Since the war, wages in the US steel industry have risen more than in other trades; last May steel wages were $3.10 an hour, compared with $2.23 in manufacturing as a whole. To this must be added 25 per cent. on straight-time hourly earnings for "fringe benefits." It has been calculated that the rise in steel prices accounted for 40 per cent. of the rise in the wholesale price index between 1947 and 1958. One aim of managements, stoutly resisted by the unions, was the elimination of "feather-bedding."

Congress has given the President powers which the United Kingdom Government does not possess —for example, to declare that a strike, if continued, would "imperial national health and safety," and then, after inquiry by a fact-finding board, to ask the courts for an injunction against the strikers. Apparently the Taft-Hartley Act has been invoked 16 times since 1947, but only twice has it "produced a fairly quick settlement." Unlike a British court of inquiry, a fact-finding board is not empowered to suggest a solution. Mr. Roberts believes that more drastic powers will have to be given to the President, but they should stop short of compulsion.

While British trade unions have not resorted to the American type of massive stoppage, Mr. Roberts fears that they are getting more militant; he adds that "we cannot afford, and public opinion will not stand, the excesses of large-scale stoppages of work in major industries." If employers and employed will not come to a voluntary agreement, Mr. Roberts declares that they must submit to compulsory arbitration. There is one way in which America beats us: a collective agreement "is generally a comprehensive document which seeks to cover every aspect of employee-management relations," and it is a "legal contract" which can be enforced, while our type of agreement merely settles a few points. Moreover, the American type "practically eliminates wild-cat strikes," while here an agreement does "not discourage workers from striking when they reach a deadlock on a local issue." The only penalty is a loss of strike pay.

Mr. Roberts does not notice that high wages make strikes easier, because the strikers are well above the poverty line. Time was when a strike was usually to gain a "living wage," like the "docker's tanner."

One suggestion made by Mr. Roberts is the introduction of "more comprehensive written agreements, with provision for arbitration." He admits the existence of such an agreement in the mines, but points to the large number of unofficial strikes in the last decade. This fact he explains simply: "Tough measures would have caused a major explosion." But Mr. Roberts insists on action, saying that Britain is "the only leading industrial country in which this problem is of major importance."

New rules naturally raise difficulties; he commends the policy of the American shipbuilders in arranging an impartial committee of arbitration; he suggests that this example might be followed in this country. No doubt, as output rises, the unions will demand "higher wages, shorter hours, and longer holidays."

Would it be possible, Mr. Roberts asks, to spread the advantages of a rising output by long-term agreements to provide improvements in wages and working conditions in return for a pledge by the unions to renounce strikes and to settle grievances by arbitration? The agreement should avoid an increase in prices. Is there no chance of "improvements" to customers by way of price reductions?

Criticism "Harmed" Machine-Tool Industry

CRITICISMS of Britain's machine-tool industry in three recent, unpublished reports were unjustified and had harmed the industry's export potential, claimed the Machine Tool Trades Association in a statement last Friday. The statement was issued to combat "considerable talk" of the reports, whose non-publication had been taken to indicate a "sad state of affairs in the industry."

"The industry has been well aware of the intensification of competition in all the world markets over recent years and has not allowed any course to meet that competition to remain unexamined," the statement said. "It was, for example, among the van of those who pressed for the elimination or reduction of the so-called 'Strategic Embargo List,' the reduction of which opened additional markets. Its participation at the Leipzig Fair was marked by the immediate purchase of a greater part of its exhibit than was accorded any other participating western country, and has been followed by several repeat orders."

Of the first report, a paper by the Department of Scientific and Industrial Research, the MTTA said: "It was compiled with the fullest co-operation of the machine-tool industry." It contained confidential technical information which, if published, would be of advantage to home and oversea companies.

The MTTA said that the second report, by Prof. S. Melman, an American industrial expert, was not concerned with any individual machine-tool manufacturing country in western Europe and perhaps less with the United Kingdom than any other. Publication of this report was surely a matter for the European Productivity Agency, which commissioned it.

About the third report, by the National Production Advisory Council of Industry, the MTTA stated: "This report again is a document prepared for a body, which alone must be responsible for its publication or non-publication."

Mine Mechanization

TREND TOWARDS FULL AUTOMATION

JEREMIAHS who see no hope or future for coal get short shrift from Mr. H. E. Collins, production and reconstruction member of the National Coal Board, who, in an article in the Golden Jubilee number of the journal of the Association of Mining Electrical and Mechanical Engineers, answers the question: "Will coal be needed 50 years from now?" His unequivocal reply is that coal will continue in demand over the next 50 years or more, possibly in quantities greater than are being used at the present time.

Surveying the present energy sources, Mr. Collins states that Britain has reserves of coal adequate for several hundreds of years. World reserves of coal are prodigious and vast quantities of water power remain undeveloped. Potential reserves of oil are considered insufficient for more than a century and, at the present rate of consumption, might be exhausted before the year 2000.

MR. H. E. COLLINS

By the end of the 20th century the contribution of nuclear energy might be vital to the maintenance of the living standards likely to be achieved; indeed, it might then be true to say that the limiting factor in improved standards will be the availability of primary energy.

Revolutionary Development Needed

"Considered from the strategic standpoint and having regard to the unequal distribution throughout the world of the various sources of energy, the position of coal in many western European countries, and indeed in the USA, will be considerably strengthened by the passage of time," he writes. "There appears to be no doubt that the demand for coal will continue. There will be fluctuations in the curve of consumption, similar to the trough now being experienced, but the tendency will be upwards."

The production of a wide range of oil products from coal is already technically possible and a small number of plants are now operating on a commercial basis in some parts of the world. Wider application of such processes, particularly in Britain, depends upon the hard facts of economics. Chaos, particularly in transport, would result from an interruption of long duration in oil supplies and, having regard to the limited resources of oil and its capricious distribution throughout the world, coal might yet be required to provide an alternative source of oil, Mr. Collins believes. He also sees it making an increasing contribution to the raw materials supplied to the chemical industry.

Britain's good resources in coking coal will provide a basis for industrial security for a very long time to come, he states. Pressurized total gasification of non-coking coals is now a commercial proposition and a plant of the Lurgi type is under construction in Scotland. The future will see an extension of this form of coal utilization with large gasification plants sited on the coalfields. This will require development of high pressure mains for gas transmission to the chief centres of consumption.

Turning to methods of coal production Mr. Collins writes: "Almost all modern mining techniques may be considered as development along well-established lines and progress has been evolutionary. It might be a good thing if in the years ahead it became revolutionary. Using a biological analogy, what is wanted is a mutation or a series of mutations—a sudden stepping aside from the strict evolutionary development."

At the present time two thirds of the expenditure required to produce a ton of coal represents the cost of ancillary operations and at the coal face all operations are not strictly productive, albeit with present methods, essential. Emphasizing that we must look to methods which will improve face efficiency by reducing the non-productive work, Mr. Collins points out that the highest output per manshift (over three months) at the coal face in fully-mechanized longwall workings is about 20 tons. The average for the country is 5½ tons for mechanized faces and 3¼ tons for all faces. In the best regulated colliery the o.m.s. for all employed rarely exceeds half that at the face.

The immediate future will see a considerable increase in the use of power-operated mobile hydraulic supports. In the longer term it is not difficult to imagine coal getting by remote control with a "manless" coal face. Already such a machine has been developed and is undergoing trials underground, he states.

It consists of a compressed-air driven cutting head which is propelled forward into the coal and subsequently retracted by a hydraulic ram fitted to a propelling unit located in the gate road. The cutting head takes with it a belt conveyor which allows uninterrupted movement of coal from the face to the loading point. The NCB's Mining Research Establishment has devised a method of remote control of these machines which will ensure that the cutting unit remains in the coal, despite variations in seam inclinations, by the back-scattering of gamma rays from a radioactive source which varies with the reflecting medium—stone or coal. Electronics will be enlisted to complete the control from signals emitted from the nucleonic sensing probe.

Mr. Collins also thinks that the use of closed-circuit television for monitoring coal-face and other underground operations may ultimately have a wide

application and the possibility of remote control through a central control room of all underground operations cannot be ruled out. He is convinced that machines must be designed which will advance the roadhead in one operation and eliminate the use of explosives.

In conjunction with the mechanization of road-making it will be necessary to design improved methods of roadway support. Since the tunnelling machine cuts a circular section road, support is likely to be based on a complete circular structure with yield provision against inevitable strata convergence. Such supports will initially be expensive, but the operating and maintenance costs are likely to be lower than those associated with supports of traditional design. And at the roadhead a separate support may be designed in the form of a movable shield of circular construction incorporating hydraulic retracting devices to be moved forward or backward with the face.

There is certain to be a considerable extension of locomotive haulage with large capacity bunker-type mine cars, Mr. Collins foresees, and a much wider use of electric trolley locomotives. Transport along arterial roadways would be simple, but there remains the question of efficient supplies along gate roads serving individual faces. The development of a rubber-tyred vehicle is proceeding; the monorail system has been established and there is considerable scope for its extension. Within the period under consideration these systems should become standard practice.

In the field of winding, the writer estimates that there will be a further trend towards skipwinding for coal with cage winding reserved for men and materials. The immediate future should also see a marked extension in methane drainage. It is likely that at very deep mines there will be large refrigeration plants on the surface from which chilled water would be pumped to heat exchangers situated close to or in working places underground—cooling and drying the ventilation air and so providing comfortable working conditions for the men.

Another likely development is automatic air sampling with the analyses continuously recorded in the surface offices. Vacuum dust collectors are also likely developments so that coal dust and stone dust will be extracted at source.

Dealing with broader issues, Mr. Collins feels that it would be of national advantage if there were a move towards a combined economy in respect of the main fuels. It should be possible to associate a large colliery, or group of collieries, with a coking plant and, where appropriate, a complete gasification plant, with the possibility of extension to plant for oil production and electricity generation. The idea might be further extended in collaboration with the chemical industry as chemical raw materials would be made available by the coal-processing plants and electricity supply would be readily available.

"Continued prosperity in the coal industry of Britain will not just happen," he concludes. "It must be planned. The dependence on machines over the next 50 years will be more pronounced and the men employed will become more and more machine-minded."

THE 130 FOUNDRYWORKERS who stopped work last week in protest at conditions in the die shop at the Neptune Works, Ayr, of the Scottish Stamping & Engineering Company, Limited, went back on Monday, pending negotiations. Complaints concerned ventilation in the factory and being called on at short notice to work overtime.

Sharp Fall in ECSC Coal Stocks

PITHEAD coal stocks in the European Coal and Steel Community fell by more than 1,000,000 tons in December—the biggest fall since the start of the coal crisis some two years ago. Provisional figures published by the High Authority give stocks at the end of 1959 as 31,270,000 metric tons, compared with 32,406,000 tons a month earlier, and 24,538,000 at the end of 1958. Stocks, which fell sharply in all the major coal-producing countries of the Community, were thus back at the level of six months ago and have fallen for three successive months.

The fall in coke stocks was much less pronounced. During December they fell from 8,612,000 tons to 8,573,000 tons, compared with 7,015,000 tons at the end of 1958.

Short-time working in December was again considerably reduced, amounting to the equivalent of a reduction in coal output of 335,000 tons, against 423,000 tons in November and 868,000 tons in October. For the whole of 1959 short-time working corresponded to a total of 12,264,000 tons of coal not produced.

The average number of days lost through short-time working during the year ranged from 2.70 in the French Lorraine coalfield and the German Aachen coalfield, to 56.81 in the Belgian Campine. In the Ruhr 11.27 days were lost and in the south Belgian coalfield 51.16.

Role of Management is Theme for BIM Conference

ROLE of management in a modern industrial society forms the theme of the Midland conference of the British Institute of Management at Leamington Spa on March 31 and April 1.

Lord Piercy, chairman of the Industrial & Commercial Finance Corporation, Limited, will open the conference with an address on "The Responsibilities of Industry to Society," and Mr. A. H. Frampton, joint managing director of Hawker Siddeley Industries, Limited, will examine criticism by oversea markets of British industry.

Other speakers will include Mr. R. R. Hopkins, personnel and welfare manager, Vauxhall Motors, Limited, on morale in industry, and Mr. Jack Cooper, chairman of the National Union of General and Municipal Workers, who will discuss what the worker looks for in industry.

GKN (SOUTH WALES) APPOINTMENTS

NINE appointments are announced by Guest Keen & Nettlefolds (South Wales), Limited. They are:—Assistant works manager, Mr. R. Stewartson; development engineer, Mr. N. A. Makin; nail factory manager, Mr. R. D. Hooper; nail sales manager, Mr. H. H. Matthews; assistant nail sales manager, Mr. Tom Jones; section mills manager, Mr. D. T. Davies; deputy chief accountant, Mr. E. G. Davies; wire rod mill manager, Mr. G. B. Smith; assistant export manager, Mr. Len Davies.

All the above officials have been with the company for a number of years.

In Parliament

COAL INDUSTRY ATTACKED

Mr. Nabarro's " Wild Statements "

OUTSTANDING liability of the National Coal Board to the Minister of Power in respect of compensation and capital advances at the end of 1959 was £941,000,000. The board's accumulated deficit on profit and loss account, less reserve fund, was about £50,000,000. This reply, given by MR. JOHN C. GEORGE, Parliamentary Secretary to the Ministry of Power, to LT.-COL. WALTER BROMLEY-DAVENPORT (Con.), prompted the questioner to suggest that the mining industry had followed " the golden rule set by all nationalized industries " to give the public worse service and quality at greatly increased cost to the consumer.

MR. FREDERICK LEE (Lab.) rallied to the Coal Board's defence. In 1958, he said, its profits were over £180,000,000 from coal workings despite the fact that about £60,000,000 was lost on importing foreign coal. The board had also paid back to the Ministry about £240,000,000 in interest rates since it came into existence. Qualifying Mr. Lee's remarks and correcting Col. Bromley-Davenport, MR. GEORGE said it was not taxpayers' money concerned. The money was paid from the Consolidated Fund and the National Coal Board had not defaulted in its responsibility to pay interest or to repay principal.

MR. JOHN C. GEORGE

The attack was then taken up by MR. GERALD NABARRO (Con.), who said that with regard to the board's continuing losses, they might reach the astronomical figure of £100,000,000 by the end of this year, all of which had to be provided by the taxpayer and nobody else. Never at any time did Mr. Nabarro produce any facts to back up his statements, MR. GEORGE retorted. His statements were very often of a very wild nature and this was no exception.

Yardstick of O.M.S.

It was then MR. EMANUEL SHINWELL's turn. He is a former Labour Minister of Fuel and Power. " Do I understand that, in spite of this sniping against the National Coal Board— "

MR. NABARRO: " Not sniping against, voting against."

MR. SHINWELL "—the Government does not intend to denationalize the coal industry? " MR. GEORGE gave him the necessary assurance.

MR. NABARRO then said that in view of " the wild reply " of the Parliamentary Secretary he would raise the matter on the adjournment at the earliest moment.

COL. BROMLEY-DAVENPORT's next question concerned average output per miner each year since the coal industry was nationalized. When MR. GEORGE said that average output per man-year rose from 265 tons in 1947 to 305 tons in 1951 and 294 tons last year, MR. LEE commented that the reply had knocked Col. Bromley-Davenport for six and made him too timid to ask a supplementary.

Output per manshift, either on that level or on the price of coal, said Mr. Lee, showed that the British coal industry was one of the most valuable coal industries in the world and was a very great credit to the NCB and the miners.

MR. GEORGE agreed that output per manshift was in some ways a better yardstick than output per man-year since it eliminated variations in work-time. It had moved upwards with no substantial reverse from 1.09 tons in 1947 to 1.26 tons in 1958 and to 1.33 tons in 1959.

In view of the fact that there had been at least a 75 per cent. increase in mechanization in the mines, production ought to be considerably higher said COL. BROMLEY-DAVENPORT. Which did the Ministry consider the bigger millstone round the necks of the taxpayers—the mining industry or British Railways? he asked.

MR. GEORGE said he was not aware the Government considered either mining or British Railways a millstone. His defence of the industry prompted MR. WOODROW WYATT (Lab.) to remark that Mr. George had left the coal mines when they were nationalized and had now come back to them because he had seen how well the industry was working and, he added, " he is defending it very effectively."

Replying to MR. THOMAS IREMONGER (Con.), MR. GEORGE said coke supplies were abundant and supplies of other manufactured fuels were generally better than last year. Anthracite supplies to the inland market should be increased this year, though not enough to meet all demands for top qualities. Up to the moment it had not been necessary to turn down any request for the declaration of a smokeless zone because of shortage of suitable fuels.

He agreed with MR. LEE that the creation of a smokeless zone did not mean that coal could not be burned in that area. The amount of smokeless fuel

was quite extensive and if the public demanded it the Coal Board could produce far and away more than was now produced.

Power Stations' Use of Fuel Oil

PERCENTAGE of sulphur contained in fuel oil used in this country from Middle East sources was about 3 per cent. and about 75 per cent. of the fuel oil burned in the UK came from Middle East sources, said the PARLIAMENTARY SECRETARY TO THE MINISTRY OF POWER, Mr. John C. George, in reply to MR. WOODROW WYATT (Lab.). Sulphur burnt in fuel oil from Middle East sources was just as harmful as that from coal burnt in non-smokeless appliances, said MR. WYATT. Could the Clean Air Act be amended so that oil installations burning Middle East oil were not automatically exempt from the provisions of the Act and so that coal was able to compete on equal and fair terms with oil? he asked.

MR. GEORGE agreed that fuel oil was about equal to coal in terms of affecting the atmosphere. But, he added, one could not generalize. On average each ton of Middle East fuel oil had twice as much sulphur as a ton of coal, but fuel oil had a higher calorific value than coal and each ton of fuel oil did the work of 1½-2 tons of coal. The comparison, if anything, went against coal.

The MINISTER, Mr. Richard Wood, told MR. JOHN CRONIN (Lab.) that just over 3,000,000 tons of fuel oil was used in dual-fired power station boilers in 1959, out of a total fuel oil consumption at power stations of about 4,000,000 tons. He was considering possible further modification of the programme for power stations. He corrected a possible misunderstanding which might have arisen from his reply to the debate last week by saying that total possible displacement of the use of oil in power stations would benefit coal to the extent of about 7,500,000 tons.

In reply to MR. FREDERICK LEE, the Minister recalled that in 1955 it was estimated that the total fuel requirement of the power stations in 1965 would be about 12,000,000 tons more than the estimated available electricity coal. The gap had now been eliminated. The original oil conversion programme provided for the consumption of about 5,500,000 tons of oil (equivalent to 9,000,000 tons of coal) in 1965. This had been modified to 3,000,000 tons of oil (5,500,000 tons of coal).

MR. LEE said the Minister's answer showed that as the NCB was now in very great trouble there was no economic reason why these power stations should not switch over to coal burning.

MR. WOOD pointed out that the Central Electricity Generating Board was discussing with the oil companies concerned a possible modification of its long-term contracts for oil supplies.

COAL UTILIZATION RESEARCH

HAVING regard to the enormous turnover of the coal industry, the amounts spent on research into the utilization of coal were absolutely minute, said MR. WOODROW WYATT (Lab.). Private enterprise would be spending a far higher proportion in similar circumstances. He thought it scandalous that the Gas Council, operating a nationalized industry, should be spending £230,000 on research into the gasification of oil. The Minister ought to persuade it to spend more money on research into the gasification of coal.

MR. RICHARD WOOD, Minister of Power, reminded Mr. Wyatt that the research being carried out by the Gas Council was intended to lead to the gasification of coal. If the Wilson Committee, which he hoped would be reporting in the near future, suggested other lines of research, he would give them every consideration.

MR. EMANUEL SHINWELL (Lab.): "Is it not absurd that after years of propaganda about the need for research into the uses of coal by-products and the like —and after the appointment of a scientific adviser to the National Coal Board in 1946 when the industry was nationalized—there is now talk about setting up a committee to consider the use of coal for by-products?"

SLOTHFUL AND NIGGARDLY

REPLYING to MR. WOODROW WYATT (Lab.), the MINISTER OF POWER, Mr. Richard Wood, said all gasification of coal developments at home and abroad were kept under examination by the Ministry and the industries concerned. Current research projects included work on slagging gasification and the hydrogenation of coal. Most of the new processes now available for use originated abroad. They included the Lurgi and Ruhrgas processes.

To have to take a process from Germany instead of developing our own was indicative of the slothful attitude of the Government towards the whole subject and the niggardly amounts spent on research, said MR. WYATT.

The MINISTER replied that the Lurgi process was the most economical so far discovered for the total gasification of coal.

LIQUID METHANE EXPERIMENT

SOME 9,400 tons of liquid methane, equivalent to about 940,000,000 cub. ft. of town gas, were imported in 1959, at a cost under the arrangements governing the experiment of about £165,000, said MR. RICHARD WOOD, Minister of Power, replying to MR. JOHN CRONIN (Lab.) and MR. ALBERT ROBERTS (Lab.). No specific proposals had been made to him for importing liquid methane on a commercial scale, but such imports would not necessarily be to the disadvantage of coal. Important processes for the gasification of coal which provided a "lean" gas needed enrichment by some such method as this.

The experiments were not likely to go on for very much longer before certain proposals were made to him, the Minister thought.

THE REPORT on the research and development requirements of the machine-tool industry made by the Department of Scientific and Industrial Research does not come within the terms of reference of the Board of Trade sub-committee, which is dealing primarily with problems of production, said the Parliamentary Secretary to the Board of Trade in a written reply to Mr. Austen Albu (Lab.).

THE PRESENT FORM of the NCB's accounts, which show items of expenditure, including compensation for surface damage, in the year of the account only, fully meets the requirements of the Act, said the Minister of Power, replying to Mr. Edwin Wainwright (Lab.). He would not direct the board to include in its annual accounts a cumulative statement of compensation paid in respect of property damaged by subsidence from 1947 onwards.

TRUSTEES OF Micklefield Colliery (Yorks) Relief Fund, raised in 1896 when 63 miners were killed in a disaster there, learned at their recent annual meeting that there is only one surviving recipient, a Mrs. Shillito, whose husband died in 1943.

Threat From Oil

COAL BOARD CHAIRMAN'S WARNING

"THE coal industry is not an old, tired giant on its deathbed—as some would appear to suggest. Very far from it. Indeed, the coal industry has dealt with a recession in demand unequalled since the early 1930s and has come through it so far with a remarkable increase in efficiency," said Sir James Bowman, chairman of the National Coal Board, on Monday. He was speaking at the luncheon in London of the Coal Industry Society in terms he described as, in many ways, "supplementary and complementary" from the management's view to what had been said a month previous at the society's luncheon by Mr. Will Paynter, general secretary of the National Union of Mineworkers.

"I would be the very last person to pretend that the coal industry does not have serious problems. Of course it has," said Sir James. "But, after all, we are here to solve them, not to lie down under them." Explaining the background to the present circumstances he said it was imperative that the causes of the industry's difficulties should be seen clearly if the reasons for the action taken were to be appreciated—"and the reasons why I refuse to be a pessimist about the strength of the coal industry," he added.

Plans to use oil for electricity generation were drawn up four years ago when it was thought there was a danger of a coal shortage. They were now in the ironical position of seeing oil being used in large quantities at power stations while the NCB held in stock ample supplies of fuel required by the electricity industry.

NCB's "Serious Concern"

There were nine power stations burning oil which had facilities for dual-firing and could, without any great physical difficulty, turn back to coal. The board believed that, in every way, it was in the national interest that they should do so. The Government's policy was that any control over the freedom of choice of fuels would be wrong and the NCB plans were necessarily based on the assumption that that policy would continue.

"But I must state," said Sir James, "that we are seriously concerned about the quantities of fuel oil being imported from abroad into this country."

It was reasonable that the oil companies should seek to find markets in this country for the products of the home refinery industry, but in fact the bulk of the additional sales of fuel oil in recent years had come from the increase in net imports. This oil was imported at a price well below the cost of crude oil, of which it was one of the products, and the pressure to import still more was bound to increase with import taxes designed to protect western Germany's coal industry.

A contraction of old and uneconomic pits would have had to have happened in any case. The real oil crisis would come if, as a result of Europe having protected her own coal industries by restrictions or taxes on oil, Britain was called upon to face a continuing increase in oil imports. If with the coal industry built up to a high level of efficiency it had to face what could amount to the dumping of oil; if it was unable to compete successfully and had to face a further contraction then it would be pits with vast reserves, in which large capital sums had been invested—good pits, efficient pits, profitable pits—which would face the prospect of being closed down.

"That would be real crisis, because there would not be a lot more the industry could do for itself. I know it is this, more than anything else, that is the union's fear and that underlies much of its insistent demand for a national fuel policy," Sir James declared.

He asked that the measures to be taken this year should be seen firmly in the context of the next six years' programme. The board was determined to cut output to at least the level of demand and aimed to start lifting stocks. In the past the sky had been the limit for output, but for 1960 Divisional Coal Boards had been given maximum output allocations which must not be exceeded. In 1960 it was hoped to have stabilized the position and by 1965 there should be recovery of demand to between 200,000,000 and 215,000,000 tons.

Finally, Sir James reminded his audience of the complete reversal in the coal situation in less than three years. "I myself took up my appointment with the task of giving the country the coal required, not of finding what to do with the coal it didn't want. To have had to plan for contraction instead of expansion —and when we were on top—has caused me great disappointment and frustration. I know my colleagues have shared the same feelings, but I must pay tribute to the determined efforts made by everyone concerned to help in pulling the industry through its troubles.

"I join Will Paynter in expressing the determination of the management and men of this industry to fight for coal. Our paths may be different, but they are parallel; our objective is the same. Believe me, we shall yet see a healthy and prosperous coal industry bury its self-appointed undertakers," he said.

EBBW VALE MILL BREAKS RECORD

THE hot strip mill at the Ebbw Vale steelworks of Richard Thomas & Baldwins, Limited, broke a record during the week ended January 30, when it rolled 23,791 tons of steel. The previous best output was 23,609 tons in the week ended December 12, 1959.

Production has been increasing steadily in the mill in recent months. It was re-motored last summer, before which the average weekly output was about 16,000 tons.

Passing Thoughts . . .

LIKE the Phœnix that no second knows nor third, we have put first things first. But now we have broadly achieved our objective. It is time that we lifted our heads and, as a nation, began seriously to consider some of the developments in the world around us. I have in mind, of course, some of the changes and movements in the international economic situation. —SIR OLIVER FRANKS, chairman of Lloyds Bank, Limited, in his annual statement to shareholders.

Now a few words about the people who work in United Steel—"operatives" if you don't mind a new word. I don't like it; why should we not say "people" which brings us all together?—SIR WALTER BENTON JONES, *chairman of the United Steel Companies, Limited, speaking at the company's annual meeting.*

He is the epitome of a resident chairman. He is at work before most of his staff, and remains in the office till closing time. He joins others in sifting the morning mail, so that he has a detailed idea of the firm's order-book.—Article in the Sheffield Telegraph on Mr. F. A. Hurst, 76-year-old chairman of Samuel Osborn & Company, Limited.

Financier? That's a good one. Put me down as a plain, commonsense engineer. That is what I always wanted to be and that is what I am.— SIR ROY DOBSON, *managing director of the Hawker Siddeley Group, Limited.*

A Nantgarw lodge spokesman yesterday denied a miner's story that a group of colliers in the Little Rock district of the "showpiece" pit near Pontypridd were paid a special rate of £22 10s. a week for working a waterlogged seam. "It is causing trouble at home," he said. "Wives are accusing husbands of holding back some of their pay."—Western Mail reporter.

I believe in moving men in top level management. After four or five years in one job they have used all their creative ideas.—MR. J. D. PEARSON, *deputy chairman and chief executive officer of Rolls-Royce, Limited.*

For the first time since the war we have inflation by the throat. And what is more we have it by the throat in a period of vigorous economic growth.—MR. A. BARBER, Economic Secretary to the Treasury.

If it is impossible to say that Britain's top earners are going from strength to strength, at any rate we now have the evidence that they are holding their own. They are a small band, of course, and, taking one year with another, they have their ups and downs like everybody else.— Political correspondent of The Times.

The logical end of the process of take-over bids in industry is the existence of two groups—the giants, and those which are too small for the giants to trouble about.—MR. W. I. FRENCH, retiring president, at the annual meeting of Glasgow Chamber of Commerce.

I have come to the conclusion in the last year or two that the greatest requisites if you want to get in authority to advise the industry are you should never have seen a pit, you should never have been down one, and you should know damn-all about miners anyway. Given these conditions you are in a position to tell the Coal Board all they want to know about the industry.—SIR JAMES BOWMAN, *chairman of the National Coal Board.*

If some coal-face workers on piecework rates do earn good money, I doubt very much if their wages are any higher than those of many men in the car industry, for instance. People forget that coal mining is an arduous and dangerous job. If some of our critics worked beside our men for only a couple of hours they would say they were worth £10 a day.— MR. BERT WYNN, secretary of the Derbyshire Area of the National Union of Mineworkers.

One executive . . . in a key position openly admitted that his house had not enough cupboard space to accommodate the little odds and ends— a few cases of whisky, several hundred cigars, and one or two food hampers—that he received in the course of his duty.—MR. IAN MARSH, *writing in Scotland, the magazine of the Scottish Council (Development and Industry).*

Mr. Wood last week said: "I would not be so optimistic as to say that no oil would continue to be used in power stations." Why should he speak of optimism in this context?—The Times.

NCB's Economy Measures Affect Kent Coalfield

OUTPUT at Betteshanger Colliery, one of the three which comprise the Kent coalfield and, with the Central Rescue Station, the South-Eastern Division of the National Coal Board, is to be cut by 50,000 tons this year. By the end of this month two coal faces are to be closed and 140 men dismissed, it was announced on Wednesday. Of those declared redundant 40 will be found work at other collieries or alternative employment at Betteshanger.

The colliery employs some 2,000 men and a spokesman of the divisional board said that the contraction at Betteshanger was part of the NCB's rationalization policy. The colliery was chosen as it was the least efficient of the division's pits.

Leaders of the Kent Area of the NUM, who met representatives of the South-Eastern Divisional Coal Board on Monday, oppose the proposals. They want either alternative employment for all redundant men or the men "carried" until vacancies occur.

Excellent Prospects for Nottinghamshire Pits

REPRESENTATIVES from the 10 Nottinghamshire pits in No. 4 Area of the East Midlands Divisional Coal Board discussed the part which the Area is expected to play this year in recruitment, production, and sales at a conference on Tuesday called by the Area general manager, Mr. F. D. Severn. With him were Mr. C. Round, Area production manager, and Mr. L. Clarke, NUM agent.

Referring to stocks, Mr. Severn said that since the beginning of the year 17,000 tons had been lifted—but more than 22,000 tons had been laid down. There had been a "terrible shortage" of railway wagons, but now they had British Road Services going right into the colliery yards and things were improving.

He appealed to everyone to persuade individuals and industrialists to use coal instead of oil and to advertise the good future prospects that existed in coal. There would be no large reduction in output or manpower and with mechanization on the increase there would be more efficiency. Long-term prospects in the Area were excellent.

Non-ferrous Metals

UTAH COPPER SETTLEMENT

Contradictory Reports Affect London Prices

THE settlement announced at the end of last week between the Kennecott Copper Corporation and the three local craft unions at its Utah division is being looked upon as the forerunner of an early settlement with the other two big copper producers, Anaconda and Phelps Dodge. It will be recalled that Kennecott came to an *ad hoc* settlement with the Mine, Mill, and Smelters' Union some weeks ago, the agreement reached covering all its divisions other than that at Utah, which was the most important, employing, as it does, some 6,500 men and producing nearly 170,000 tons of copper a year.

Negotiations have been dragging on, with reports that a settlement was imminent only to be followed by another report that negotiations had been broken off. At the same time, the information on the other two producers was no less confusing, and the last word on progress between these two companies and the union was that Phelps Dodge was making some progress towards a settlement, but that Anaconda had broken off negotiations. The contradictory reports made for wild fluctuations in the London price structure, but, on the whole, the trend was always upwards. By Thursday of last week the London cash price had gone over £272 a ton, representing a premium of about £18 a ton over three months' metal.

The report that a settlement had been reached at Utah and that the men would return to work immediately caused the London quotation for cash metal to come back a little more than £10 a ton last Friday, since when price movements have been in switchback fashion.

Future Level of Prices

If a settlement is soon reached with Phelps Dodge and Anaconda, prices in London will definitely slide and the backwardation will gradually but persistently close up as copper production in the US begins to rise. Nevertheless, the London market has had a good run, and although the price structure is bound to be vulnerable for some time, it is to be remembered that demand is good both from the UK and the Continent and that available stocks are low. The US price structure may soon witness some changes. At present, however, custom smelters continue to quote 35 cents and producers 33 cents a pound.

Tin is an unsteady market in London and New York, but continues firm in the East. The London market was puzzled last week by the statement from the chairman of the International Tin Council, M. Peter, that at the end of September the buffer stock held 11,150 tons of tin. M. Peter had said earlier that the buffer stock would hold at least 10,000 tons of tin at the end of 1959, and as it was known that the buffer stock manager had sold appreciable quantities during the last quarter, the announced figure looked very high indeed. One explanation is that the buffer stock manager may well have been buying on an equally appreciable scale in the East to make up for his disposals in London. The outlook for the metal continues fair on both sides of the Atlantic. In the US the price is over $1.00 a pound.

Lead is firm and the price has recovered its earlier losses quicker than many believed it would. Trading activity is good with demand steady. In the US the price is unchanged at 12 cents a pound.

Zinc is still a good market in London and New York, but somewhat irregular, possibly due to the International Lead and Zinc Study Group meeting in Geneva. The prime function of this group is to consider ways and means to obtain internationally comparable statistics on a continuing basis, which would enable producing countries to collaborate in a practical way on the position and prospects for the metal at any given time. Although the group can only recommend, it is believed that the opportunity will be taken by member countries to avail themselves of the opportunity to announce their plans. It has even been hinted that the present restrictions on the export of zinc will be abolished altogether, and that a recommendation may be made that those on lead will be maintained until the middle of the year.

In London, demand is good, but price movements have been small owing to the belief that supplies will become easier. Nevertheless, the statistical position for the metal is good. In the US, the price remains at 13 cents a pound.

Official metal prices in London yesterday (Thursday) were:—COPPER, Standard: Prompt £263 15s., forward £245. TIN, Standard: Prompt £792, forward £789. LEAD: Prompt £73 12s. 6d., forward £74. ZINC: Prompt £89 15s., forward £89 17s. 6d.

Wellman Smith Owen (Furnaces), Limited

SALES organization of the furnace building department of the Wellman Smith Owen Engineering Corporation, Limited, is to operate as a separate subsidiary company under the title of Wellman Smith Owen (Furnaces), Limited. The following executives of the parent company have been appointed directors of the new subsidiary under the chairmanship of Sir Peter G. Roberts, MP:—Mr. G. Talbot (managing); Mr. C. D. Wattleworth; Mr. W. H. Day; Mr. C. Brooks; and Mr. D. A. Hume.

Other additional board appointments within the group are:—Mr. Day and Mr. V. Bellingham, directors of the Wellman Bibby Company, Limited; Mr. Hume, a director of Robinson & Kershaw, Limited.

Law Cases

JUDGMENT FOR COAL BOARD

CLAIM for damages for personal injuries brought by Mr. Cyril Chopping (45), a mineworker at Frickley Colliery, South Elmsall (Yorks), against the National Coal Board failed at Leeds Assizes. Mr. Chopping stated that he was assisting in a team of six in April, 1956, to move diesel rails on a bogie to the locomotive shed. He tripped over some debris, and his right arm was caught under one of the bogie wheels and badly fractured. He alleged negligence on the part of the NCB.

The board denied negligence and alleged contributory negligence, maintaining that the plaintiff did not trip over an obstruction, but slipped when assisting to push the bogie.

Mr. Commissioner Megaw, QC, giving judgment for the NCB, said he regretted having to find against Mr. Chopping as he was a reliable and conscientious man and had done his work well. Had he been able to find in his favour he would have awarded £400 damages and £172 special damages.

CONTRABAND CHARGES DISMISSED

NO evidence was offered by Mr. W. Kinghorn, appearing for the National Coal Board, at Blaydon Magistrates' Court when two charges of having cigarettes and matches underground at Stargate Colliery, Ryton (Co. Durham), were brought against Thomas O'Farrell (42). The magistrates therefore dismissed the charges.

It was stated later that Mr. O'Farrell had been suspended from work because of the alleged offences, but if he made an application for reinstatement it would be considered.

MR. JUSTICE DAVIES at Durham Assizes dismissed a claim for damages against the NCB brought by Mr. William Beart (63), a pit deputy at Eppleton Colliery, Hetton-le-Hole. He was struck in the face by a metal clip used to fasten a rope on to pit tubs. The NCB denied negligence and alleged contributory negligence by the plaintiff.

Success of ICI's Wages by Credit Scheme

DETAILS of a successful experiment in paying wages into an employee's bank account have been revealed by Imperial Chemical Industries, Limited. Cheques are not involved in the system, which operates by an instruction to the paying bank to credit the required amount of wages to the receiving banks where employees' accounts are kept.

The scheme was introduced at the Wilton works (Yorks) in May, 1958, at the request of weekly-paid employees. The employee gives a written request to the company for his wages to be paid each week to a bank account at a branch he may choose from a list of about 70 branch banks in the Tees-side area. Afterwards, the money is automatically credited weekly to his account.

Although the scheme is still regarded as experimental, its success may be gauged by the increasing numbers using it. When the experiment was launched, 226 (or 3 per cent.) of the 7,494 weekly-paid employees made use of the new facilities. By December last year, 1,968 (24.2 per cent.) of 8,148 weekly-paid employees were receiving their wages in this way.

6 Per Cent. Drop in Coal Output

COAL output at 16,311,700 tons for the first four weeks of the year is running at about 6 per cent. lower than for the similar period last year. Deep-mined output has been reduced by 4.4 per cent. and open-cast by 34 per cent. As the effect of pit closures began to be felt last year and output, particularly from the Midlands and Yorkshire coalfields, builds up this year, a complete reversal of trends is likely to be seen. Output per manshift at the face is now 3½ cwt. better than a year ago.

Consumers' stocks continue to fall and for the week ended January 23 were 13,182,000 tons, compared with 15,469,000 tons in 1959. The diminution is most noticeable in merchants' stocks, underlining the transport and labour difficulties which are being encountered by merchants all over the country.

There were 630,900 wage-earners on colliery books on January 23, against 680,400 on January 24, 1959, the numbers engaged at the coal face being 241,500 and 265,400, respectively. Total absenteeism (all workers) in the week ended January 13, was 14.79 per cent., compared with 14.49 per cent. in the week ended January 24, 1959. Output at the face was 3.887 tons and overall 1.386 in the week ended January 23, compared with 3.707 and 1.359 in the week ended January 24, 1959.

The following table gives (in tons) the output of saleable mined coal by division in the week ended January 30, and the tonnage lost through all causes (holidays, disputes, and go-slows):—

Division.	Week ended January 30, 1960.		Week ended January 31, 1959.
	Total output.	Tonnage lost.	Total output.
Scottish	381,400	2,200	393,200
Northern (N & C) ..	245,900	—	268,900
Durham	477,200	—	483,100
North-Eastern ..	850,300	15,700	871,800
North-Western ..	278,800	300	303,000
East Midlands ..	917,900	—	942,400
West Midlands ..	296,300	14,000	333,800
South-Western ..	421,300	4,900	443,200
South-Eastern ..	34,600	—	34,500
Great Britain—			
Deep-mined coal ..	3,903,700	37,100	4,073,600
Other deep-mined (including licensed mines) ..	53,200	—	54,600
Open-cast coal ..	144,500	—	262,700
TOTAL	4,101,400	37,100	4,390,900

BRITISH ROPES TO OPEN MEXICAN WIRE MILL

A NEW wire mill is soon to be opened in Mexico by British Ropes, Limited, Doncaster. This project follows the success of a wire rope factory—Cables Mexicanos, SA de CV—established by the company in Mexico two years ago. New plant and machinery are being sent from Britain and the USA, and although the venture was not embarked upon until late last year, production is expected to start early this summer.

The company is sending out a number of its Doncaster personnel to help with the establishment of the factory and training of Mexican staff.

BETTER COAL-YEAR FOR SCOTLAND

Divisional Chairman Looks to the Future

FEATURES of the Scottish coal industry's operations in 1959 included a rise in productivity, an extension of mechanization, and a lowering of production costs, said Mr. Ronald W. Parker, chairman of the Scottish Divisional Coal Board, at a Press conference in Edinburgh on Thursday of last week. He claimed that the year was one of improvement despite a period of contraction, and added: "We are building up our sales and technical services to give expert advice to industrial users."

In the industrial field, Mr. Parker stressed that coal should be given a fair chance to compete with alternative fuels as a fuel for industry. "There is just one thing we want from consumers," he said. "Where they are contemplating a change to new plant we want coal to be given an opportunity to show what it can do.

MR. R. W. PARKER

"We have a strong feeling that in many cases the costs and performance of obsolete coal-burning plant are being compared with modern plant, burning alternative fuels. Consumers should remember that it is costs and not fashions that will help Scotland. Coal does seem to be a little out of fashion at present."

Mechanization Welcomed

Turning to the board's operations, Mr. Parker said that output per manshift in the mines averaged 20.9 cwt., representing an improvement of 7.1 per cent., compared with the 1958 figure, as against the overall increase in Britain of 5.3 per cent. This was the largest productivity increase for any coalfield in the country.

The raising of production was helped by the closing of low-productivity pits and the gradual introduction of new and reconstructed pits. The biggest factor, however, was the increase in power-loading to get coal by mechanical means at the coal face. Mr. Parker said that the proportion of coal won in this way had risen from 17 per cent. to 27 per cent. during 1959. He felt that this development could be carried further in 1960.

Mechanization was welcomed by the board and the men, while for the consumer higher productivity meant stable prices. "And it is our clear-cut intention to keep prices stable," said Mr. Parker. "We are taking our own steps to make coal as competitive as possible." He said that the demand for coal was less than in 1958, but that business had improved during the past few months.

Working costs in 1959 were down by between 2s. to 3s. a ton, reported Mr. Parker. Financial losses would thus be rather less than in 1958 when the division incurred a loss of £13,900,000 before charging interest. But he warned that the losses would still be high, because much of the financial benefit arising from increased productivity and economies was offset by the increased stocking of coal.

Recruitment was being severely restricted by the divisional board, he said, and natural wastage being allowed to take its full effect. Because of this, manpower fell by 6,300 to 76,400 during the year, but one of the major tasks was to redeploy men affected by pit closures. "There is only a relatively small number we have not been able to place in other employment," he went on. "For the 300 men concerned it is a difficult position, but I would draw attention to the fact that the number of miners registered at labour exchanges in Scotland is only 1.5 per cent., and that compares with 4.5 per cent. of all unemployed."

Mr. Parker referred to a point raised by Mr. Abe Moffat, president of the Scottish NUM, that "about 800 men had been found jobs at wages reduced by as much as £7 10s." "I would like to put that matter in perspective," Mr. Parker went on. "About 800 men were transferred to a lower rate of wages, but the average drop will be about £1 a shift. I also hope that these men will eventually transfer back to the higher paid jobs—it will depend on the circumstances at their new pit."

The prospects for youth employment were now more encouraging. During the year, many boys had been refused admission into the industry. This year, said Mr. Parker, the board hoped to offer employment to 2,000 youths—more than double the number accepted in 1958.

Good Profits from Gas Purification Group

NOTICEABLE feature of group progress in the last 18 months of the Gas Purification & Chemical Company, Limited, London, E.C.2, is that although the profits from Grundig (Great Britain), Limited, continue to improve, these results are now accompanied by many substantially increased contributions from other subsidiaries.

Those subsidiaries reporting increased profits are:—A. B. Metal Products, Limited; B. & R. Relays, Limited; E. G. Irwin & Partners, which recently announced a Spanish steel mill contract; Johnson British Electric, Limited; and Wolsey Electronics, Limited.

Group profits for the six months ended December 31, 1959, are not less than £500,000 and the directors have declared an interim dividend of 15 per cent. on account of the year to June 30, 1960. The dividend is the first since the 20 per cent. interim in 1956-57.

"Less Formal" Address by United Steels' Chairman

CAPITAL cost to the United Steel Companies, Limited, of providing employment in 1947 was £1,350. Last year it was £3,100. These were among details given in a "less formal and more personal" address by Sir Walter Benton Jones, chairman, at the annual meeting of the company on Thursday of last week. Reviewing the company's progress since the war, he said it had spent £103,800,000 on properties—not "on building new works on green fields," but in replacement and modernization to improve efficiency.

Its aim had been to get "more out of pint pots . . . not only beer but wines" and, using iron and steel making as examples, Sir Walter said that in 1947 United Steel made 955,000 tons of iron. In 1959 this had been increased to 1,757,000 tons and by the end of next September it was expected to make 2,000,000 tons. The 1947 figure for steel was 1,700,000 tons; in 1959 it was 2,597,000 tons, and by the end of September it should be 3,150,000 tons. The increases over 1947 were:—For iron in 1959, 80 per cent. and, in 1960, 109 per cent., and for steel, 53 per cent. and 85 per cent., respectively.

In spite of the greatly increased output of iron and steel and greatly enlarged production of the many things made compared with 1947, the number of men employed in 1959 was 37,728, compared with 30,818 in 1947, an increase of no more than 22 per cent.

"Operatives at all levels spend their working lives on the company's properties and nearly all regard them in a way as their homes," he continued. "It can be helpful if proprietors also look upon their companies as real possessions and the people who work in them as live persons like themselves. Is not the conception and retention of individuality the alternative to Communism?"

Sir Walter reminded shareholders that although more railroads might be built in expanding countries and even for special purposes in developed countries, the world was looking to newer forms of transport which required steel in other forms. Railway undertakings were large users of steel and would no doubt look for supplies to experienced and well-tried steelmakers who would have to accommodate their plant and operation to changing circumstances.

Colour films had been made of some of the company's works in operation and had been seen by about 16,000 shareholders and friends. The project was to be extended and a film of the Scunthorpe works of the Appleby-Frodingham Company was now being produced.

ORDERS PLACED FOR SCOW EXPANSION

ONLY a week elapsed between the approval of the Iron and Steel Board for the fourth development plan of the Steel Company of Wales, Limited, and the announcement by the chairman, Mr. Harald Peake, at the annual meeting on Tuesday, that firm orders totalling £4,600,000 (approximately 25 per cent. of the SCOW expansion plan) have been placed in order that work can proceed at once.

Mr. Peake said that the current year had begun well and he hoped that before it had finished the company would achieve the results which the £52,000,000 third development plan was intended to provided.

Shipbuilders Reply to Unions' Claims

SHIPBUILDING employers, faced again with demands for higher pay and a 40-hour working week, promised the unions concerned on Thursday of last week that they would consult associated firms. But Mr. G. H. R. Towers, president of the Shipbuilding Employers' Federation, told union representatives that since these claims were rejected last November there had been no real change in the unfavourable outlook for shipbuilding and shiprepairing. He reiterated that employers were not opposed in principle to fewer working hours, but that it was essential first to remove obstacles to maximum efficiency.

Appealing for union co-operation and a "cessation of troubles," Mr. Towers added: "It would be dishonest to suggest that without that co-operation the industry can face up to a reduction in hours when the position is so grave."

Mr. F. Foulkes, president of the Confederation of Shipbuilding and Engineering Unions, said the employers' claims were exaggerated and that there was too much generalization about isolated incidents. Mr. E. J. Hill, chairman of the Confederation's Shipbuilding Committee, claimed that the employers were unduly pessimistic about the industry's prospects. Productivity had been greatly increased with the men's goodwill and co-operation, and many yards had been able to claim record completion times for shipbuilding in the past two or three years, he said.

Wire Nail Manufacturers' Delayed Statement of Case

APPEAL by certain manufacturers of wire nails from the refusal of the clerk of the Restrictive Practices Court to grant further time for delivery of the statement of case was allowed by the court on Monday. Mr. W. Gumbel appeared for the manufacturers and Mr. J. F. Donaldson for the registrar.

Mr. Gumbel said the statement of case had been filed on January 26 and the list of documents accompanying it on January 28. It was originally due to be filed on June 20, 1959, but there had been a number of extensions, expiring eventually on December 16, 1959. The clerk of the court had refused to grant a further extension.

The main reason that the matter had taken so long was that this was not a case of a trade association with a secretariat, but of nine individual manufacturers of wire nails. A more elaborate procedure than usual was required to prepare and have approved a carefully drawn statement of case.

Although the clerk had been right in refusing further time, said Mr. Donaldson, it was not in the public interest to debar the manufacturers from presenting their case.

On any view of the matter there had been unreasonable delay and the registrar, therefore, applied for an order for 25 guineas costs.

Mr. Justice Pearson, who presided, said the court would order that the purported delivery of the statement of case on January 26 should be treated as if it were good and valid delivery, but there had been unreasonable delay and the manufacturers would pay the costs claimed.

IRON AND STEEL TRADE

FURTHER expansion in the total demand for goods in the United Kingdom this year, which is forecast in the latest issue of the Economic Review, is a conspicuous characteristic of the steel trade. Fixed investment is accelerating, giving a further impetus to the demand for most types of finished steel. Ingot production continues to rise. Subject to confirmation, the January output is believed to be the biggest ever. Direct exports of iron and steel are running at a record rate, imports have been reduced to the smallest total since 1948, and the industry has budgeted for an increase of 50 per cent. in this year's capital expenditure upon new equipment.

Pig-iron

More blast furnaces are at work, but the rise in pig-iron production, which is keeping pace with the swelling requirements of the steelworks, has been chiefly accomplished by increasing the yield of the blast furnaces already in operation. Beneficiation of iron ores and the growing use of oxygen have been abundantly rewarded by bigger outputs and reduced fuel consumption.

Last year's increase of approximately 500,000 tons in the imports of foreign ore has been provided from Canada, which is now established as the principal source of our oversea supplies.

Ferro-alloys

A good demand is being maintained for most items. Ferro-tungsten is receiving steady attention and shows no further change in price. The major grades of ferro-silicon are attracting strong support and ferro-chrome and calcium silicide are in steady request. There is a good demand for ferro-manganese and silico manganese.

Ferro-niobium and ferro-titanium are quite active and the call on ferro-molybdenum and ferro-vanadium is at a good level.

Semi-finished Steel

Pressure for semi-finished steel output in all its manifold forms—blooms, billets, slabs, sheet and tinplate bars—is intense, and the further increase in ingot and slab mill capacity which is embodied in the steel industry's development plans bespeaks confidence in the continuation of the rising trend of demand from the finishing mills.

Particularly active is the market for light bars. Re-rollers are heavily booked over the next few months and are pressing for bigger deliveries of the smaller sizes of billets. Arrivals of foreign semis have been reduced to very small proportions.

Finished Steel

The very considerable expansion of strip mill capacity, which is a conspicuous feature of the steel industry's development plans, offers no prospect of immediate relief from existing shortages and it is difficult to acquire extra tonnages from external sources. But in all other sectors, rollers have thus far been able to cope with the heavier demand. Just as the depression in the industry was accentuated by stock reductions, which in the aggregate amounted to about 1,000,000 tons, so also has the subsequent reversion to stock replenishments accentuated the boom. Deliveries, however, are keeping pace, and works appear to be holding closely to promised delivery dates, although these are now extending.

The building and constructional engineering trades are leading the revival and this has brought a corresponding increase in the call for all types of structural steel.

Scottish Plant Contract for English Electric

A COMPREHENSIVE contract for all the electrical equipment in three steel-rolling mills has been awarded to the English Electric Company, Limited, by Colvilles, Limited, for its new Ravenscraig plant, near Motherwell, the biggest industrial project ever undertaken in Scotland. All the equipment will be engineered by English Electric's metal industries' division and manufactured mainly at Stafford. Manufacturing will also be done at Bradford, Liverpool, and Kidsgrove. Delivery will be completed by the end of 1961.

Most important of the three mills is the semi-continuous hot strip mill. Besides light plate, this will produce hot-coiled strip which will be further rolled into sheet steel for cars and domestic appliances. The strip mill will be fed from the universal roughing and slabbing mills, both of which are of the hot-reversing type with twin-drive motors. On the slabbing mill these will have a total of 14,300 h.p. and on the roughing mill, 10,500 h.p. For distribution of power within the plant, English Electric is also supplying 17 1,500 MVA 33 kV air-blast circuit breakers, to be manufactured in Stafford by the switchgear division.

It is hoped that the building of the Ravenscraig plant will encourage "consumer durable" industries to establish themselves in Scotland, where, in fact, some of the mechanical equipment for the plant will be made.

Disputes Cost 5,250,000 Working Days in 1959

LAST year saw 1,788,000 more working days lost through industrial disputes than in 1958, in all 5,250,000 days being lost and 644,000 workers being involved. Ignoring the printing dispute, coal mining was the industry most affected by disputes, but the number of stoppages, men involved, and working days lost showed a marked decline.

Days lost in shipbuilding showed a marginal decline, but more than 35,000 of the 315,000 lost were due to demarcation disputes. In metal manufacture days lost more than doubled to 71,000, but nearly half this total was due to the four-day stoppage at the Port Talbot works of the Steel Company of Wales, Limited.

Weekly wage rates increased by just over 1 per cent., compared with 3½ per cent. in 1958, 5½ per cent. in 1957, 7¼ per cent. in 1956, and 7 per cent. in 1955. There was no general increase in most of the major industries, but towards the end of the year a trend towards shorter hours became apparent, affecting more workers than in any year since the war.

Contraction in ECSC Coal Output

WEST GERMANY has allowed itself to be outvoted by the other five members of the European Coal and Steel Community in its objection to an amendment of the ECSC Charter to deal with the coal situation. Previously aid could only be given where production cuts had to be undertaken as a result of the existence of the Common Market. Now the granting of aid has been extended after the expiry of the original clause next Tuesday and aid may be given where cuts are not directly due to the Common Market.

Finance required to deal with the coal situation has forced the ECSC to revise its long-term budgeting. Total expenditure for long-term programmes will now be spread over a number of years instead of being credited to the year in which the programmes begin.

It is now possible to make a comprehensive survey of ECSC coal production in 1959. Overall it was down by 4.7 per cent. on 1958, but in the second half of the year had recovered by 1 per cent., compared with the same period the previous year. Imports contracted sharply—by 39 per cent. for the year and by 49 per cent. for the second half of the year. Productivity, however, showed a marked upward turn between June and December, 1959, rising by 6.5 per cent. for the Community as a whole.

Coal stocks varied considerably. For the ECSC as a whole they dropped by 1.7 per cent. in the second half of last year, by 9 per cent. in West Germany, and 1.6 per cent. in Belgium. Saar stocks increased by 4.9 per cent. and French stocks by 6 per cent.

Vigorous efforts are being made by Ruhr coal producers to set up a marketing syndicate. Dr. H. Burckhardt, managing director of the producers' association, Ruhrbergbau, has stated that the proposal to cut production capacity by 11,000,000 tons a year must be accompanied by a unified marketing outlet and some control of fuel oil competition. Potential coal sales in 1960, he said, were put at 110,000,000 tons, 4,000,000 tons of which would come from stocks. Potential production for the year was 117,000,000 tons, hence the need for production cuts.

According to figures issued by the High Authority of the ECSC 52 requests have been received from West Germany connecting with the contraction in coal production. They concern 71 installations and 57,000 workers.

The figures imply the total closing of 19 pits, five pit cokeries, and a briquette factory, and the partial closure of 45 pits and one pit cokery.

As a buffer against the effect of such drastic economy measures, the Ruhr Action Group has been set up by all Ruhr coal producers. In the next three years between DM300,000,000 (over £25,000,000) and DM500,000,000 (about £41,750,000) is to be raised to finance the closure plans of member companies.

Recent reports available to the ECSC indicate the growing strength of the Community's steel market. Only from Italy comes news of fresh price increases—and decreases. Ilssa-Viola has raised its prices for band steel by 5 per cent. and for fine sheet by 3 per cent., and La Magona has raised prices for fine sheet and cold-rolled broad band steel by about 2.8 per cent., leaded and galvanized sheet by about 2 per cent., and certain semi-manufactured iron grades by 1.5 per cent. Bolzaneto has levelled its prices to those of leading Italian producers by reducing thick sheet prices by 5.3 per cent. and Meroni has cut the prices of certain steel semi-manufactures by 8 per cent.

Hope Abandoned for South African Mine Victims

HOPE that any of the 435 miners entombed in the Coalbrook North Colliery, Clydesdale, Orange Free State, may have survived was abandoned early this week when drillings revealed that in addition to the roof falls there had been considerable flooding of the workings. When the drills broke through into the area where the men—six Europeans and 429 Africans—had been trapped pipes were sunk in order to draw up air for sampling.

Instead of air, however, water was drawn up and further tests indicated that the first drill hole contained water forced up to within 94 ft. of the surface. The water was almost as high in the second borehole. The extent of the roof fall on January 21 is not fully known, but judging from surface reaction it is believed to have extended over an area of at least a square mile.

In a statement giving an account of events since January 21 the directors of Clydesdale (Transvaal) Collieries, Limited, state that all the resources of the mine were being directed to rescue operations and safety measures. Until these were concluded no detailed study could be undertaken of the ultimate effect of the accident.

The company is under contract to supply the coal requirements of the Taaibos and High Veld power stations of the Electricity Supply Commission. Output from Coalbrook South Colliery is being rapidly increased, and it is expected that it may be possible for that colliery to meet the major part of those requirements until permission is given for operations to be resumed at Coalbrook North.

Coal Board's Senior Press Officer

IT was announced by the National Coal Board on Wednesday that Mr. Henry Donaldson has been appointed senior Press officer in succession to Mr. Geoffrey Kirk, whose appointment as the Coal Board's chief public relations officer was announced a fortnight ago.

Mr. Donaldson, who is 49, was educated at the Salesian College, Battersea. He gave up a post with the United Africa Company, Limited, to do freelance writing and then joined the Milk Marketing Board. In September, 1939, he started his war service as an instructor in the King's Royal Rifle Corps, was later commissioned, and went oversea with the 1st Bn. Cambridgeshire Regiment in October, 1941. When Singapore fell in the following February he was taken prisoner and spent the rest of the war in Siam, working on the notorious Burma-Siam railway.

He joined the public relations branch of the NCB in 1947 and was appointed Press officer in January, 1949.

YORKSHIRE IS TO BE GIVEN wider coverage by the sales organization of Martin, Black & Company (Wire Ropes), Limited, Coatbridge. The county will now be covered from the company's office at 13, Sandhill, Quayside, Newcastle-upon-Tyne 1 (telephone: Newcastle 2-1282), instead of from its Midlands office. Mr. A. R. Jenkin is in charge of the Newcastle office.

MR. T. S. CHARLTON

MR. T. S. CHARLTON

MR. THOMAS SOULSBY CHARLTON, deputy chairman of the West Midlands Division of the National Coal Board since 1952, comes from a family which have been connected with the coal-mining industry for the last two centuries. After obtaining his early training in Yorkshire, and a M.Sc. degree at Leeds University, Mr. Charlton spent four years as undermanager at Deep Pit, in the North Staffordshire coalfield, before moving on to re-open Gresford Colliery after the explosion there in 1934. He returned to Yorkshire as general manager of the Cortonwood Colliery Company in 1939, and in 1945 he was appointed joint managing director of Amalgamated Denaby Collieries. Before nationalization he was a director of several colliery and coking companies in South Yorkshire and North Wales and, as a member of various committees connected with those industries, he acted as umpire in labour disputes.

In 1946, Mr. Charlton was appointed deputy production director in the North-Eastern Division, NCB, but before vesting day he was transferred to the South-Western Division as production director.

For two years (1940-42) Mr. Charlton was president of the National Association of Colliery Managers, and has always taken a keen interest in the activities of the association. He is a member of the Institution of Civil Engineers and of the Institution of Mechanical Engineers, and has been a member of the council of the Institution of Mining Engineers for 16 years. He was a vice-president of that institution for six years. He was founder president of the South Western Society of Mining Engineers, the formation of which meant that the Institution of Mining Engineers then represented all the coalfields of Great Britain. He later took part in the merger of the society with the South Wales Institute of Engineers. Mr. Charlton has served as a Magistrate for 20 years and currently sits on The Wrekin Bench.

His family is helping to maintain the traditional connection with the mining industry. His wife, Mrs. D. M. Charlton, O.B.E., B.Sc., is chairman of the Women's Advisory Council on Solid Fuel, and his elder son is at present an undermanager in Yorkshire.

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METHOD STUDY IN MINING

Its Structure and Operation

By L. DAWSON* and R. R. O. GERMER†

Method study is entirely dependent for its success upon the whole-hearted co-operation and understanding of management and men alike. In this paper, presented to the North of England Branch of the National Association of Colliery Managers on November 18, 1959, the authors outline the development of method study in the mining industry, describing the basic structure and aims of the technique.

METHOD study sets out to provide the essential facts on which management can operate in making the most effective use of manpower, machines and materials. It has been said that method study staff are doing the work which should have been done by management and are there to correct the faults of management. This is not true; management in industry today cannot afford the time to study in detail all the operations under its control so it is clear that the modern manager must co-ordinate the work and activities of a number of specialists. The method study engineer is one of these specialists and he is not concerned with what happened in the past, but how improvements can be made. Another comment sometimes made is that method study is all very well for other industries but could not be applied to coal mining. It has now been proved that the application of method study to various operations has been successful and has led to improvements in efficiency.

Suspicion from workmen is also aroused but this is usually overcome by proper consultation and full explanation of what is to be done and the possible implications. In fact many trade unions are ready to co-operate in the introduction of method study, but, since they are there to protect their members, they must ensure that any new proposals as the result of method study application, do not operate to their disadvantage.

It is surprising how the most obvious truths are those which are most readily overlooked. Although everybody will be in complete agreement when you want to apply organized common sense to an operation, there is resistance when you come to do something about it; it is found that habit is much stronger than common sense, whether common sense is organized or not.

Introduction of Method Study

The modern techniques of method study have been developed during the past 40 or 50 years and many industries in this country and abroad apply these techniques as a means of improving productivity and reducing costs.

Method study, even though it may have been applied under a different name, is not new to the mining industry. In certain metalliferous mines abroad, the techniques have been tested and proved over a number of years. It is firmly established in the gold mines in Ghana, and in Dutch collieries organized method study has been in use for over 25 years. In Germany, also, these aids to management are in use, while in France, work study has come into prominence very rapidly since the war. Nor are the ideas of method study new to our opposite numbers in Poland and the USSR. The team of NCB experts which visited Russia to study Russian mining practice, reported that each mine employs between four and six engineers solely engaged on method study.

Prior to January, 1947, a few British colliery companies, in addition to carrying out straightforward timing of operations, which we have all carried out at some time, even brought in firms of industrial consultants to advise them, but the techniques never appeared to "catch on" as rapidly as they did in many of the newer industries. Late in 1950 the NCB considered the application of method study to mining and in view of the nature of the techniques and of any possible misunderstanding by the various unions, decided that the introduction must be both cautious and gradual.

Before starting on a national scale, a survey was made by a firm of industrial consultants at a large colliery, and at the same time, a senior mining engineer was seconded for a period of training in method study in industries other than mining. After 12 months, both the mining engineer and the consultants, had arrived at the same conclusion, that in most phases of coal mining there was considerable scope for the application of method study techniques.

The reports of the consultants and the mining engineer were considered by the board who decided to appoint and train one senior method study engineer in each Area. The prime function of these engineers was to ensure acceptance of the techniques by both management and men in the industry. At the same time, the National Union of Mineworkers and the National Consultative

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Council were kept fully informed of the board's intentions.

By the end of 1955, sufficient work had been done to verify that there was great scope for the techniques in raising the productivity in the industry, and the board decided that suitable staff should be trained for all Areas. By the end of 1958, there were 348 trained method study engineers in post. Compared with other industries and the mining industry in other countries, this figure is very low.

It will be understood that with an industry employing in the region of 700,000 to establish a branch of this sort is quite a task, and it is to be expected that the techniques would be more readily accepted in some divisions than in others, and these divisions would proceed more rapidly with the appointment and training of staff. In both Northern (N & C) and Durham divisions a method study branch was established about five years ago in one Area only, and it was not until between November, 1956 and April, 1957 that Area method study engineers were appointed for the remaining Areas, followed by the appointment of other staff.

Method Study Branch of the NCB

Method study is a specialist branch of the board's production department. At headquarters in London there is a small team under the chief method study engineer who is responsible to the deputy director-general of production (operations), and whose main tasks are to co-ordinate the efforts of method study nationally, to run central training and appreciation courses on a national basis, and to ensure the general development of method study on sound lines.

At divisional level there is a divisional method study engineer whose job it is to co-ordinate the Area activities in method study. and to ensure that these activities are directed to the most productive investigations.

At Area, which is the operational level, the Area method study engineer has a staff under his direct control, a staff which should amount to 12 to 16 in an average size Area. The Area method study engineer controls his staff as teams, directing them to collieries as and when required for individual studies. Because of the very nature of mining it is almost always necessary that more than one man and very often up to four or five are required to carry out an efficient study of an operation, it has, therefore, been decided that method study engineers should not be attached to individual pits.

In the method study branch of mining engineering it is essential, as in other industries, that the right type of man is recruited. Although mining experience is an advantage and engineering experience is desirable, it is vital that the method study engineer should also have a right approach to people and have all the personal qualities which are necessary for carrying out the work and "selling" ideas to both management and men. The ideal method study team should consist of a suitable blend of mining, mechanical, and electrical engineers.

With an industry as large as mining, it is essential that standard techniques only, should be used on a national basis and that both management and unions should understand fully the techniques used by method study engineers.

Training courses of one month's duration are held nationally at which persons appointed as method study engineers are taught the basic techniques after which they return to their particular Areas where they assist in carrying out studies under the supervision of the Area method study engineer. It is essential at this stage that centralized field training is carried out, in order to ensure that standard techniques are applied throughout the industry, and also to make certain that information on studies is available to all Areas and divisions on a common foundation.

Both management and men should understand the techniques used by method study engineers because method study is a service to management and requires the fullest possible co-operation of the unions involved. To achieve this, appreciation courses in method study for colliery management and union officials have been held nationally for the past few years, each course being of two weeks' duration. In addition to colliery managers and union officials who attend these courses in about equal proportion, other junior officials are now attending, particularly deputies whose work brings them in close contact with the men, and who can be of great help to the method study engineer on the job.

It is apparent that this system has been of immense value in putting over the techniques of method study, with the result that at a number of collieries, when it was introduced, both the manager and the union representatives already understood its purpose.

Need for Method Study in Mining

In all industries it is the aim of management to organize their particular industry so that it is running at the highest operational efficiency. This applies equally to the mining industry, and there are a number of ways which will assist in achieving this aim. The first is by reconstruction designed to improve basic processes and layouts and provide better plant and equipment. This is only a partial answer to the problem and is necessarily long term, and usually requires large capital expenditure.

Another means is by mechanization or by using power loading for the getting of the coal. During the past few years, this has been intensified, but there will always be faces which will have to remain hand filled due to their unsuitability for power loading. In the short term it has been shown that an immediate marked improvement in efficiency can often be made with existing equipment by improved method and minor changes in layout. This is where method study can greatly assist, but it requires a willingness on the part of management

and men to make and accept changes which will serve the common purpose.

Mining requires the services of method study as much as any other industry to determine the "standard" to be aimed at and to be used for comparison purposes. It is easy to calculate figures of productivity and cost, because a single commodity is produced and, therefore, there is a common denominator from which these calculations can be made. However, useful as these statistics are, they are of limited value for comparative purposes, because of the varying conditions encountered at a colliery.

In spite of the changing conditions encountered, it is necessary that realistic standards of performance be established by method study techniques and at the same time ensuring that the most effective use is made of men, machines and materials. These standards, when established, will be used as the basis for production control resulting in a more realistic arrangement of the various operations at a colliery.

It must be realized that to study all operations at every colliery using the limited number of staff at our disposal will take some considerable time, but nevertheless standards are steadily being built up.

Method study may be divided into two main subjects—methods improvement and work measurement. Methods improvement aims to produce a more effective use of material, plant and equipment, and manpower. Work measurement applies the use of methods comparison and task assessment, and promotes standards for manpower deployment. The combined aim of these two factors, methods improvement and work measurement, is to promote greater productive efficiency.

Methods Improvement

Methods improvement is essentially concerned with finding better ways of doing things and contributes to improved efficiency by eliminating unnecessary work, avoidable delays and other forms of waste. This it achieves through improved layout, working procedures, and the use of materials, plant and equipment, and manpower. The techniques of method improvement aim to reveal and analyze the true facts concerning any operation or situation, to critically examine those facts, and to produce from the examination of the facts the best answer possible.

During the examination of the facts, it is usual to ask the following questions: Is the work necessary and, if so, why is it done this way? How long does it take? Can the method be simplified? Can it be done more quickly some other way?

A simple procedure for the application of method improvement is to select the operation to be studied; record all the relevant facts of the present (or proposed) method; examine the facts critically and in sequence; develop the most practical and effective method; instal the method as standard practice, and maintain the standard practice by regular checks.

Work Measurement

Work measurement has been defined as "the determination of the proper time to allow for the effective performance of a specified task." The "proper time" is determined by taking into due consideration all the factors affecting the execution of the task. Where machines are involved the task is also dependent on the effectiveness of the machine, and this must be determined.

To establish the "allowed time" for a specified task, it is usual to break down the job into elements and by direct observation to establish the "normal time" for each element. Then by allowing for other relevant factors such as fatigue allowance, events beyond the workers' control, etc., "standard time" is established.

From the standard times the number of men or machines required to carry out a specified task can be decided. It must be emphasized that work measurement calls for the greatest care and the highest degree of accuracy, since there is nothing so damaging to human relations than an impracticable standard.

It has been previously mentioned that the aim of method study is to make the safest and most effective use of men, machines and materials. This it does by seeking for the best deployment of manpower; eliminating non-productive time; improving the organization; and revealing and eliminating bottle-necks.

Manpower Deployment

In all operations at a colliery, men are involved, whether it be on the coal face, the handling of materials, or the transport of the coal from the face to the wagon on the surface. Since method study can be used to arrive at an accurate standard of manpower for any given job in a mine, it is to be understood that a standard manning for every job can be built up which management can then use in a number of ways. First, as a basis of comparison for production control, secondly, for forecasting output and equipment if necessary, and thirdly, for production planning and the effects of labour transfers from one district or seam to another.

It is possible to build up from these standards a daily manpower control system which gives management all the information required on the manning of the pit and any deviations there may be from the agreed standard manning, on which action can be taken.

Since method study was introduced in the Northern (N & C) and Durham Divisions of the NCB, a number of investigations have been carried out into the haulage of coal from the face to the shaft and it has been possible in many cases, by implementing the recommendations of method study engineers, to improve the efficiency of the haulage and in some instances make men available for transfer to other essential work.

The supply of materials to the coal face is another interesting problem which shows abundant scope for method study and in fact the work which has been done has in every instance resulted in an improved service, and again in manpower saving. A further outcome is greater economy and better control of the usage of materials by the phasing of supplies.

In other divisions, concentration has been on coal-face operations and it has been proved, particularly with regard to power-loaded faces, that it is possible to fix a practical standard of performance for the machines under the operating conditions, and also by the use of work measurement techniques, the number of men for all the ancillary tasks has been assessed. At this point it is worth mentioning that the tasks fixed do not call for any unreasonable effort on the part of the workmen involved, and since the effects of variables are made the subject of a separate study, proper allowances can then be made.

Eliminating Non-productive Time

Elimination of non-productive time in the mining industry is another field of application for method study techniques and here, again there is considerable scope.

In mining it is safe to say that most of the non-productive time can be attributed to machinery being at a standstill. Due to the complex system which is required for obtaining coal, and the physical restrictions which the very nature of the work imposes, it is often found that the breakdown or stoppage of one machine has the immediate effect of making other machines stand, or run without any production being achieved. To combat this it is essential that these machines are run at their highest possible efficiency and that planned maintenance is carried out to ensure that breakdowns are at a minimum.

Conveyors, haulages, shafts and surface plant have been studied and from the results obtained it has been possible to put before management the facts concerning the running of the various types of plant and the reasons for any stoppages, from which the necessary steps to effect improvement can be made.

In a number of cases one study has pointed the way to where further investigations and studies are to be carried out. It is noticeable that although the findings of method study are quickly acted upon by management, and efficiency very quickly increased, over a period of time the efficiency gradually deteriorates, and there is always a need to look periodically at machine utilization.

The ultimate aim is for a smooth flow throughout the haulage system both for coal coming out of the pit and materials going in, and this in itself will cut out the irritating delays caused by breakdowns or lack of materials which not only cost money but create a sense of frustration in the minds of workmen and often lead to a lower standard of work, or the ultimate loss of a complete cycle of operations.

There are a considerable number of locomotives of various types, mainly diesel or battery powered, now used underground for the hauling of coal and materials, and because of their flexibility it is essential that they are used to serve as many districts as possible. Studies in this type of haulage are in some instances not very easy to carry out. The method study engineers have to record running times and delays of the locomotives in use and at the same time the output from each district has to be determined in order that a schedule can be arrived at.

As an example, a study on the locomotive haulage at a colliery was carried out because the manager was of the opinion that he had too many locomotives in use. The study resulted in the saving of one locomotive, which increased the utilization of the remaining locomotives by approximately 20 per cent. The locomotive utilization had previously been little more than 50 per cent.

Method study can be used to some extent in revealing scope for improvement in organization in a number of the various operations which are carried out at a colliery, and which are too numerous to mention in detail. A typical result is the reduction of non-productive time.

Avoiding Bottlenecks

In addition to improving transport systems and organizing the flow of materials to the face, a special team in Durham is solely employed on investigations into tunnelling techniques. In order to achieve a high rate of advance in tunnels, the organization of the work must be of the highest order. Method study is helping to achieve this, by studying all the operations in detail, in order to arrive at the best possible method which will give the highest efficiency.

The capacity of each part of the whole system at collieries is also being determined by method study, and in the process bottle-necks come to light. It may be that production is stopped due to some particular part of the haulage, or there may be insufficient stocking facilities of loaded tubs.

These practical difficulties can be remedied and the information obtained for essential day-to-day operations and for the forward planning of the pit.

At most collieries all the coal has to be wound up one shaft and at the same time men and materials have also to use the same shaft. Serious bottle-necks can be caused unless the capacity of the shaft is known, and the winding of men and materials is properly organized.

One particular case where the method study engineers were called in was a shaft where the true capacity had to be established because of the proposed increased output at the pit. Skip winding was in operation and the results of the study spotlighted the fact that 13.3 per cent. of the available coal winding time was lost due to waiting for the skip pocket underground to fill. This represents some 600 tons of coal which could have been wound.

Further investigations proved that the fault lay in the mine-car tippler, the tipping cycle not being in line with the standard winding time. The manufacturers of the tippler were called in to rectify this fault thus ensuring that no delay of this type will occur when full production is reached.

Conclusions

The use of method study as a means of helping to raise productivity is spreading rapidly in most

countries. It is applied common sense and its principles are easy to follow. All that method study and industrial engineers have done is to organize common sense and develop practical techniques to assist in presenting and solving the many and varied problems which are involved in day to day working methods.

Method study must not be looked upon as a "magic wand." What it does is to offer a fact-finding service to assist management in improving efficiency, but it does not encroach on his responsibility for making the decisions. In all enterprises the systematic approach to problems has a significant contribution to make. Efficiency is not the special province of the expert. Every member of an industry is responsible for making the steady improvement demanded for productive efficiency.

The responsibility for initiating action falls on management, and it should be rapid and complete, but the trade unions and employees, irrespective of grade, have their part to play.

The British Productivity Council has declared that it is essential, in the national interest, to make industry as efficient and productive as possible, and that this improvement must come, not only in our factories but also on the farms, in transport services, in the offices, and in the mines of the nation. Moreover, it is only by the sustained application of the right principles that results can be achieved.

By the comprehensive use of method study and the determined approach which it implies, progressive firms have already shown improvements which can be made. The adoption of this dynamic attitude to the mining industry, the foundation on which our whole economy rests, is a key to national prosperity. In itself method study can achieve nothing: its success is dependent entirely upon the full co-operation and understanding of management and unions.

The authors wish to thank the production directors of Durham and Northern (N & C) Divisions, Mr. R. S. McLaren, and Mr. J. Brass, respectively, for permission to present this paper.

DISCUSSION

MR. T. HALL, opening the discussion, asked if the authors could give an example of how they would tackle the problem of getting back into step on a coal face if there was a breakdown after the method study has been carried out.

The AUTHORS replied that if a method study investigation was carried out and afterwards there was a breakdown, then the method study people should go back and study the whole problem again because conditions might have changed since the study had been done and other factors might come forward.

MR. R. S. MCLAREN said that there seemed to be a body of opinion amongst mining engineers that it would be very difficult for method study engineers to truly gauge the effort of men and to arrive at a norm of effort for men doing manual work, and he asked how one could differentiate between a man who was working at normal speed and one who was deliberately working at less than this.

The AUTHORS answered that it was not difficult to tell when a man was working at a reasonable rate or if he was slacking. It was not natural for anyone to work at a very slack pace for long, because it was impossible to maintain a pace of uniform slackness. If the rate was extraordinarily slow, there could only be one answer—the man was slacking.

MR. G. WIGHTMAN said mention had been made of an investigation into haulage, and he asked for a resumé of what was found there.

He also said a statement had been made that although efficiency very quickly increased after the application of method study, over a period of time, the efficiency gradually deteriorated, so there was always a need to look periodically at machine utilization. Mr. Wightman asked if this meant that the officials themselves did not follow up the results of method study investigation.

The AUTHORS replied that where a study was implemented and there was a certain method to be worked—it might, for example, be a loading point where the manpower was reduced from five to three men—it was found that over a period of time manpower increased under the same conditions. A study of conveyors had been made and it was sometimes found that conveyors were out of line, or had narrow belts, etc., which had been put right. Then, due to pressing circumstances, the conveyor belting had not been replaced and six months afterwards the same troubles were occurring again. Under-officials should be more educated in these new techniques to make them realize that the manpower required could be assessed for the jobs from the facts which had been obtained.

With regard to haulages, a specific instance could be quoted where the colliery manager wanted a reduced coal-winding period but thought that the haulage could not cope with it. The haulage was by battery locomotives, and a study was made. By a slight rearrangement in the pit bottom with running fulls and taking away empties, it was possible to reduce the coal-winding period.

MR. W. EVERETT said method study had given many reports on the problems of coal getting and the movement of coal from the colliery. It had also reported on transport of materials and on the rate of tunnelling, but up to now there had been no report on the quicker method of ripping a caunch, particularly in roadways serving mechanized faces. He asked if method study engineers had been invited by management to investigate this problem.

The AUTHORS replied that they had not yet been invited to make studies of coal-face operations or rippings.

In reply to a question on the use of method study in planning by MR. W. DAVISON, the AUTHORS said that in the paper they had shown three approaches to solving a problem, the long term one being reconstruction, which was a function of the planning branch, the short term being the field of method study. Planning was a co-ordinating function and could use the information obtained by method study as it did with other branches.

In reply to a further question from Mr. Davison on overlapping between the two departments, the AUTHORS said that there was bound to be overlapping, but 100 per cent. co-operation and co-ordination in both branches was necessary.

MR. J. MAUGHAN said the only aspect of method study which gave him cause for concern was this problem of assessing tasks on the face, and he asked if figures were available showing the amounts by which norms were being exceeded.

The AUTHORS said that it was to be expected that

the norm would be exceeded to give the men an incentive. There were no figures yet available on how far it had been exceeded. In the East Midlands and South-Western Divisions, the establishment of tasks on the face had worked very satisfactorily and both men and management were pleased. There were instances in South Wales where the norm was not exceeded, except in rare cases, by about 20 per cent., the average being 15 to 16 per cent.

Replying to MR. R. BOYD, who said that on mechanized faces the norm should be based on machine performance, the AUTHORS said that although a machine had a maximum potential, there were few installations with greater than a 50 per cent. utilization. The average would probably not exceed 30 per cent. but the tasks set by method study were very much in excess of 50 per cent.

MR. J. V. GREENSMITH asked whether it had been found that method of payment had any effect where method study recommendations had been introduced. The AUTHORS replied that as far as incentives were concerned, they had not been involved in any case. In South Wales, it was much easier to come to an agreement of price lists after the task had been set by the method study team.

MR. R. S. MCLAREN said it did not seem sufficient to study machine performance alone. On an Anderton shearer face, for example, there might be two machine men but up to 50 others in stable holes, packing, drawing off, advancing supports and the conveyor and caunching the gates. The efficiency of face operations depended also on the effort of these 50 men, and it was essential to man the face with the correct number of men to perform these tasks in relation to the machine-men's performance. This surely entailed studying all operations. Replying, the AUTHORS said in South Wales the answer to this problem was that they had set the norm for the machine and the support services manned to maintain that norm. The machine controlled the operation, and having set the task for the machine the rest of the services had to be blended to that task. This also occurred in the East Midlands where the norm for the support services were set as well.

Establishing Norms

MR. W. DAVISON asked for assurance that the method study technique permitted the establishment of a proper norm under certain conditions. In reply, the AUTHORS said that in the case of a man using a shovel, the technique could be used to determine the amount of coal that man should be moving in a normal day, making the necessary allowance for rest etc., but if conditions changed then another study should be done. As an example, one of the authors spent six weeks in a machine shop some time ago, where they were operating lathes, etc. He was put on to the milling section, where they wanted to put in an incentive scheme; he had never operated a milling machine. After two days he knew every operation of the machine and by rating and time or work measurement an incentive scheme was started. The ultimate result was a 50 per cent. increase in output and a 30 per cent. increase in the wages of the men.

MR. J. S. CARSON asked if a norm could be fixed for a man using a shovel, and thereby established for 10 men filling on a conveyor face. He quoted the case of a hand-filled face on a Monday morning when two fillers were absent and eight men filled their norm on that day, and asked how the 10 men re-established the norm on the Tuesday. Replying, the AUTHORS said that eight men on an incentive could fill off what 10 men normally did working at average rate. If the time came when production control was fully introduced and the manning of faces in order of priority was established, shortage of manpower on faces would be cut out, but method study could not alter that situation.

Replying to MR. F. H. BAKER, the AUTHORS said since method study had been introduced the accent had been on establishing what machines could do and on improving methods. There were certain things like loading points, haulages, etc., where the number of men required to do the job could be established, but delays and non-productive time had to be taken into account. The board had been right in trying to straighten things out behind the face first. If the face was working to a reasonably high degree of efficiency, it was important that conditions were in order outbye from the face to get the coal away and materials in.

Promoting Method Study

MR. R. S. MCLAREN said the most effective way of persuading men to accept method study on the face was to demonstrate that the efforts outbye had been so successful in providing better clearance of output from the face, that the face men themselves asked for a study on the face in the hope of reaping similar benefits there. Recently, in Durham, an encouraging request had been received for method study to help in a high speed drift just starting. The workmen concerned when visiting another pit, where method study had been applied to a similar drift, were told by the drifters that method study had been of great help to them personally in their efforts to increase yardage. He suggested they should watch for, and take advantage of all such opportunities, as basically the main bulk of men now seem to be convinced that improvement in efficiency was in their long term interest.

In answer, the AUTHORS said they hoped that the men on the face would ask for method study people to come. One case existed where the management and union of a particular pit, where a strike was threatened, called in method study and everyone accepted what method study suggested. Since then method study engineers had been to that pit to carry out other types of studies.

MR. E. W. POTTS asked if the authors could say how they knew at a glance whether an investigation was bound to be abortive. It had been stated that method study had been applied in various countries, but in France it was described as "work study." What was the difference between work study and method study?

Replying, the AUTHORS said method study in the board was initially called work study, but later it was decided to change the title. They did not think that one could tell at a glance whether the investigation was going to be unsatisfactory. The job had to be selected by the colliery manager. He presumably knew where his worst conditions were from an efficiency point of view and he would rather get those sorted out first, than those which were less of a problem.

MR. H. M. HEDLEY commented that in their investigation into improving layouts the method study men must have built up some very useful standards, and asked if these standards were passed back to planning branch for future major reconstructions.

Regarding passing back information to planning, replied the AUTHORS, all studies were available to planning and quite a lot of discussion took place between method study and planning departments. In Durham there were lists compiled of all studies carried out and these lists were circulated throughout the division. Any study was available for reference purposes.

INDUCTIVE STIRRING IN ARC FURNACES

Improved Homogenization by Rapid Chemical Reaction

By E. HAMMARLUND and B. HANÅS

Nearly 40 arc furnaces have been equipped with induction stirrers since their introduction about 10 years ago. Results obtained have shown that induction stirring improves the homogeneity of the bath, speeds up the chemical reactions between steel and slag, simplifies deslagging and reduces impurities. The authors, who are with the furnace department of Allmänna Svenska Elektriska Aktiebolaget (ASEA), at Västerås, presented this paper at the Fourth International Congress on Electro-Heat at Stresa, May, 1959.

THE need for the effective stirring of molten metals has been felt since the beginning of this century, and different methods of obtaining the desired mixing have been discussed. What is aimed at is, of course, a homogeneous bath and more rapid chemical reactions.

Quite a few different ideas have been tried for arranging a mechanical mixing device from simple rabbles to complicated designs for shaking or rotating the whole furnace. Some methods work with a gas that is blown through the bath, and in the "reladling" process the whole melt is tapped into a ladle. Various electrical methods have also been developed, and today the ASEA inductive stirring system is looked upon as one of the important ways of obtaining a thorough mixing of the bath.

This paper deals with the results obtained with the ASEA induction stirrer during the first decade of practical work on arc furnaces of different sizes, ranging from 10 to 150 tons, in all the leading steelmaking countries.

Working Principle

The induction stirrer, which was invented by Dr. Dreyfus of ASEA in Sweden, is, in principle, a part of a large stator of an electric motor. It is placed under the bottom of the arc furnace, the bottom plate of which must be made of austenitic steel. The molten bath itself acts as the rotor and is moved by the travelling magnetic field from the two-phase stator winding according to the same physical rules as the rotor of an induction squirrel-cage motor. Consequently, the force accelerating the melt works along the bottom of the furnace with an approximately constant value, which results in an optimal mixing effect for a given stirrer power.

The stirrer and its electrical equipment were described in detail at the Third Congress on Electro-Heat in Paris, in 1953[1], and the description will not be repeated here. The bath movement and the flow pattern on the surface are, however, shown in Fig. 1. The importance of keeping the thickness of the bottom lining under a certain limit should also be mentioned. The stirrers are designed to be mounted at a certain distance from the bath, enabling a normal and safe lining thickness to be employed. An increase in this distance, however, will bring about a considerable drop in the stirring force. This can easily be realized, when considering that this distance corresponds to the air-gap of a normal electric motor.

Metallurgical Results

The main reason for stirring the melt is to obtain a homogeneous bath and more rapid chemical reactions. Thorough investigations regarding the ASEA induction stirrer in this respect were made 10 years ago at the Swedish steelworks of Hagfors and Surahammar in a 15-ton and a 10-ton arc furnace. The very positive results of these two investigations regarding the making of steel according to the normal, two-slag, process were published by S. Fornander and F. Nilsson in 1950[3]. The results from a 90-ton furnace at the steelworks of Timken Roller Bearing Company in Canton, Ohio[5], from a 30-ton furnace at SAFE steelworks in Hagondange, France[6], and from a 30-ton furnace at Mannesmann-Hüttenwerken in Duisburg, Germany[7], were described later.

The contents of this paper are based upon these data and also upon a number of other investigations regarding the benefits obtained with the induction stirrers in the different steelworks. It is very interesting to note how the first results from Hagfors-Surahammar have been confirmed at one place after another.

Of course, the advantages of the stirrer are dependent upon the local conditions and the furnace programme in question. An aspect that is of little importance for one furnace may be predominant for another. It is striking that the repeat orders are often based upon the decrease in the number of rejects and in the amount of expensive alloy elements used, whereas the profitability of the first installation may have been calculated on a saving in furnace time.

Homogenization

The induction stirrer accelerates the melt all along the bottom of the furnace, creating a very effective

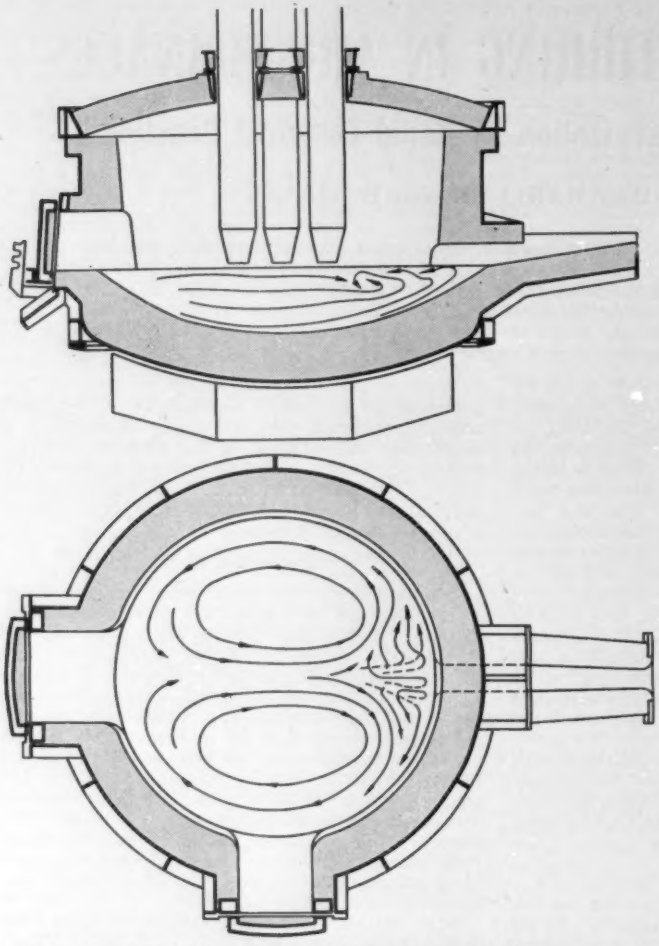


FIG. 1 (*top*).—THE BATH MOVEMENT AND (*bottom*) THE BATH SURFACE FLOW PATTERN IN AN ARC FURNACE FITTED WITH AN INDUCTION STIRRER.

mixing when the metal flow has to change direction at the wall and find its way back to the other end (Fig. 1). This results in good homogeneity and allows better overall control of the bath composition, an accurate calculation of addition elements and an exact measuring of the temperature, as illustrated by the following examples.

Samples of Bath Composition.—It has been proved that alloy elements are dissolved in a shorter time in a furnace equipped with a stirrer and that the samples, taken just a short time after the additions, are representative for the whole melt. Thus, Fornander-Nilsson[3] reported that there was no practical difference in Si and Mn between the surface and bottom samples only 6 min. after the additions when the induction stirrer was in operation. When thorough rabbling by hand alone was carried out three times, the differences were still great after 12 min. (0.20 and 0.10 per cent. for Si and 0.70 and 0.30 per cent. for Mn). Without any stirring, the differences were still greater. In all three cases, the final analysis was about 0.20 per cent. Si and 0.65 per cent. Mn and the furnace charge was about 15 tons.

At Timken[5] the differences in samples taken at different spots in the 90-ton furnace were within 0.01-0.02 per cent. of the calculated value only 5 min. after the addition of FeSi.

SAFE[6] have found that a Cr addition of about 0.9 per cent. to a 30-ton melt is well distributed within 20 min. Fig. 3 shows the Cr contents of samples from about 15 melts taken at regular intervals over a period of 40 min. after the addition. As a comparison, the corresponding curves without the stirrer are given. The difference is striking.

Fig. 4 shows the homogenization of Mn in a 40-ton melt at Avesta, Sweden. Samples were taken at the same spot at intervals of 2 min., and the contents of Mn are given as a function of the time elapsed after the addition. Curve 1, which represents an average of three melts, indicates that a time of 11 min. is required for representative samples with the stirrer. In curve 2 the stirrer was started 13.5 min. after the addition and then the melt became homogeneous after another 6.5 min.

It may be interesting to examine the influence of the magnitude of the stirring force. At Surahammar the normal time for a reliable sample is 15 min. after the addition of about 3 per cent. Si when making transformer steel. During a period of some days, when the stirring force was reduced, it was necessary to wait 40 min.

Another example can be given from a 13-ft. furnace at Hagfors, Sweden, charged with 20 tons. When making stainless steel the stirrer was operated with 250 A at the Cr addition. Two samples were taken after 30 and 50 min. The differences between these samples were considerable, up to 7 per cent. in Cr, showing that the bath composition was not yet homogeneous at the time of the first sample. The stirring force was later increased to 500 A which resulted in such small differences between the two samples that it was judged to be unnecessary

to wait for the second sample. Thus the furnace time could be shortened by 20 min.

The influence of the stirrer is, of course, even more apparent when adding heavy alloy elements with a high melting temperature such as FeMo and FeW. As they rest on the bottom of the furnace, where the melt is cooler, their dissolving can also be a problem in a small furnace not equipped with a stirrer.

Calculation of Additions.—The fact that the samples are representative of the composition of the whole bath means that there will be a saving in alloy elements, as the additions can be calculated with smaller margins than normally. This is, of course, of most importance when making high-alloy steels in large furnaces, but is an economical factor also for very small furnaces working with expensive alloying elements. It also means that steelworks with an induction stirrer can offer more accurate analysis than other works for steels made in corresponding furnaces.

This very interesting feature is demonstrated by Fig. 5, *a* and *b*, representing all the Mo-alloyed stainless steel melts (about 18 per cent. Cr, 10 per cent. Ni) made at Avesta during a certain period. The number of charges, in per cent. is plotted against the final analysis. This is here calculated as the deviation from the lower limit given to the furnace operator (the percentage value refers to the whole melt).

Temperature.—The temperature is equalized throughout the bath and even in large furnaces the temperature measured at one point is representative, *e.g.*, Timken[5]. Fornander-Nilsson[3] measured in a small furnace a difference of 19 deg. C. between the surface and bottom layer of the steel without a stirrer, but no difference at all with a stirrer.

The tapping temperature of the steel can be kept within small margins. As the surface is overheated in relation to the bottom in a furnace without a stirrer, the stirred steel should be tapped at a lower measured temperature. One 60-ton furnace was thus previously tapped at about 1,650 deg. C. in order to obtain a temperature of 1,615 deg. C. in the ladle. With the stirrer the tapping temperature is 1,620 deg. C. The homogenization of the bath also means that the steel can be overheated in a shorter time, as the heat is continuously transmitted from the hot arc zone.

When overheating a 10-ton melt with 3,500 kW, Fornander-Nilsson[3] measured a difference of 26 deg. C. with the stirrer and 102 deg. C. when it had been switched off.

Chemical Reactions

Oxidizing Period.—The oxidation of carbon is a gas-forming reaction and as the boil itself creates very good mixing of the bath, the stirrer cannot influence the main process. Through the temperature equalizing effect it can, however, help the boil to be started earlier and simultaneously all over the bath. This is especially the case when the carbon content after melting-down is rather low, or when working with ore.

If some unmolten pieces should remain, they can cause a sudden and violent boil with rapid surging through the furnace door. The risk of this happening is reduced if the stirrer is running during the last part of the melting-down period.

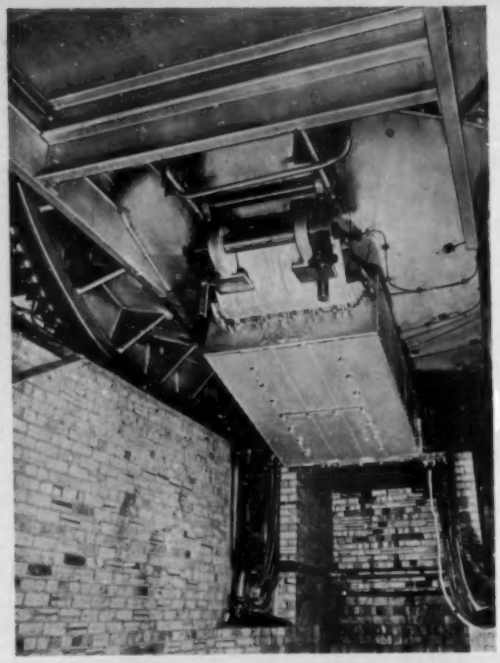


FIG. 2.—AN ASEA INDUCTION STIRRER MOUNTED UNDER A 60-TON ARC FURNACE WITH 19-FT. INNER SHELL DIA. (SAMUEL FOX & COMPANY, LIMITED, SHEFFIELD).

When especially low carbon contents are desired and the boil dies down, stirring has given good results, as, for example, down to 0.02 per cent. in Avesta. Without any stirring, in the same furnace a somewhat higher content would require a considerable prolongation of the operating time.

The problem that stirring may facilitate carbon pick-up from the carbide-reducing slag has been studied at Timken[5] where it was found that this absorption is minimal and that the carbon can be controlled more accurately with the stirrer than without.

The use of the stirrer also results in lower phosphorus contents. This is, however, mainly due to the more effective deslagging which will be discussed below.

Deoxidizing Period.—A number of the more important metallurgical reactions in a furnace for producing steel are characterized by an exchange of materials over the phase boundaries, mainly between the metal and slag, but also between the furnace hearth and the steel. The reacting elements have to be moved in some way to and from these zones, to enable the reactions to attain as far as possible a state of chemical equilibrium.

Since the average distance of the materials from

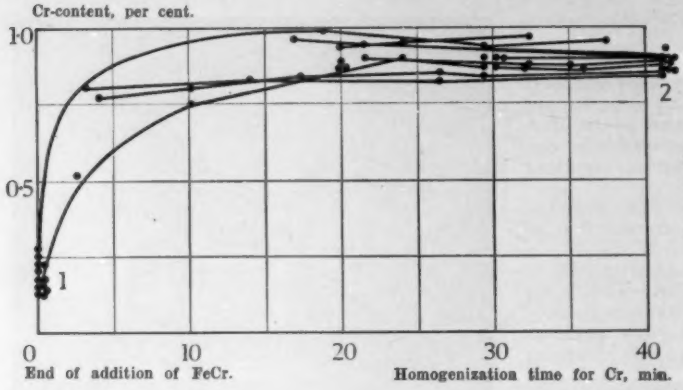
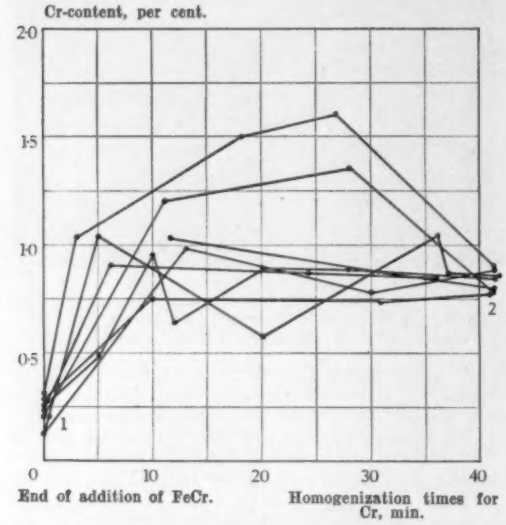


FIG. 3.—CR-DISTRIBUTION AT SAFE. ABOVE, STIRRED-HEATS AND, BELOW, NON-STIRRED HEATS.

1—Cr content before the Addition; 2—Cr-content in the Bath



these reaction zones is comparatively long, the overall reaction rate is very low in those cases where diffusion of the elements in the phases is the only means of moving the material. Fortunately, in most cases, various additional factors give rise to some external convection or stirring, which compensates for the low rate of diffusion.

The most important exception to this favourable condition is the reducing period for a two-slag procedure in an arc furnace. The bath is almost completely inert during that period. It is this fact which has necessitated various methods of providing extra stirring. The former practice of employing mechanical stirring devices was effective only to a certain extent and consequently the furnace depth was kept below a certain limit. The induction stirrer has made it possible for this limit to be exceeded appreciably, and this has opened the way to higher production through an increase in the weight of the charge.

An example of this is the 17-ft. furnace at Avesta, where the bath depth was increased from 560 to 715 mm. and the charged weight from 30 to 50 tons without any prolongation of the refining time.

Although the stirrer does not directly act upon the slag, it has been found that the slag also becomes homogenized. In their 20-ft. furnace, Timken[5] get samples just inside the slagging door representative of the slag composition of the whole bath. They also consider it easier to make and control the reducing slag and appreciate the fact that unmolten areas disappear in a very short time.

Desulphurization.—Most users of the induction stirrer have benefited greatly from the fact that it assists desulphurization, in some cases to a very considerable degree. This reaction is favoured by a high basicity of the slag, by reducing conditions and by a good diffusion to the reaction zones, as explained above.

These conditions, however, are often fulfilled without stirrers, and the use of the stirrer is most advantageous in those cases where a low sulphur content is needed. The reason for this is that the role of the furnace bottom is of minor importance as long as the desulphurization requirements are moderate.

The bottom is unfortunately impregnated with FeO during the oxidizing period. This FeO returns successively to the bath during the reducing period, thus upsetting the desulphurizing action. When an induction stirrer is fitted, however, the reduction at the furnace bottom takes place fairly rapidly, because a large quantity of reduced metal is brought into contact with the bottom. When this hindrance to desulphurization—the FeO from the furnace bottom—is eliminated, the pre-requisites for obtaining very low sulphur values can be fulfilled.

Fornader-Nilsson[3] measured an increase in desulphurization, in per cent. S per hour, from 0.0006 to 0.0009 at Hagfors, which meant a saving of about 25 min. Their investigations at Surahammar gave about the same results (Fig. 6). Timken confirmed[5] that S can be reduced to extremely low

values (0.005 per cent.) with no increase in the furnace time.

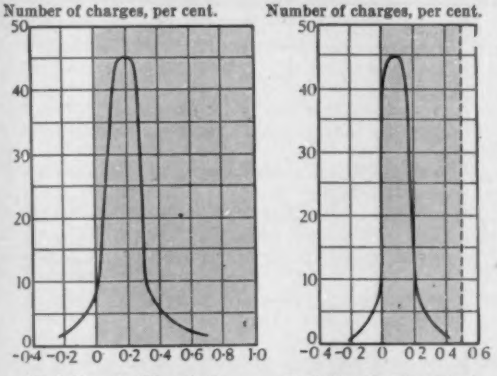
Without a stirrer it was almost impossible to get below 0.008-0.011 per cent. This can also be exemplified by Surahammar, where the mean reducing time in the old 7-ton furnace was 150 min. In the present furnace with a stirrer the mean time for an 18-ton melt is only 60 min., which implies a saving of 90 min.

SAFE[6] found that the ratio between S in slag and steel was increased by 17-20 per cent. (dependent upon the C content) and they also made an interesting experiment by not switching on the stirrer until part of the S had been reduced (Fig. 7). The sulphur contents of all reduced steels are now kept at a low and even level with a mean value of 0.008 per cent., compared with 0.014 per cent. before the installation of the stirrer.

Mannesmann[7] has also stated that desulphurization is accelerated and that the values from different melts are more close to one another. This means a reduction in the refining time, in some cases of one hour or more and also an increased precision in reaching a desired analysis.

Deoxidation.—The oxygen content of the steel decreases more rapidly and reaches lower values when the melt is stirred during the reducing period. This was described by Fornander-Nilsson[3] and shown in two curves, each representing two melts with and without a stirrer (Fig. 8). As these values are extremely low, the analytical methods have been queried, but the relation between stirred and unstirred melt is likely to be correct.

SAFE have obtained results of the same order of 0.001 per cent. O with a stirrer operating for 80 min. under white slag instead of 0.002 per cent. without a stirrer as mean values of seven and six



(*a*) Deviation from Nominal Content of Ni. Total number of Charges: 42.

(*b*) Deviation from Nominal Content of Mo. Total number of Charges: 81.

FIG. 5.—DISTRIBUTION OF ANALYSES OF MO-ALLOYED STAINLESS STEEL MADE WITH A STIRRER. THE SHADED SURFACES ARE RANGES OF THE ACCEPTED ANALYSES.

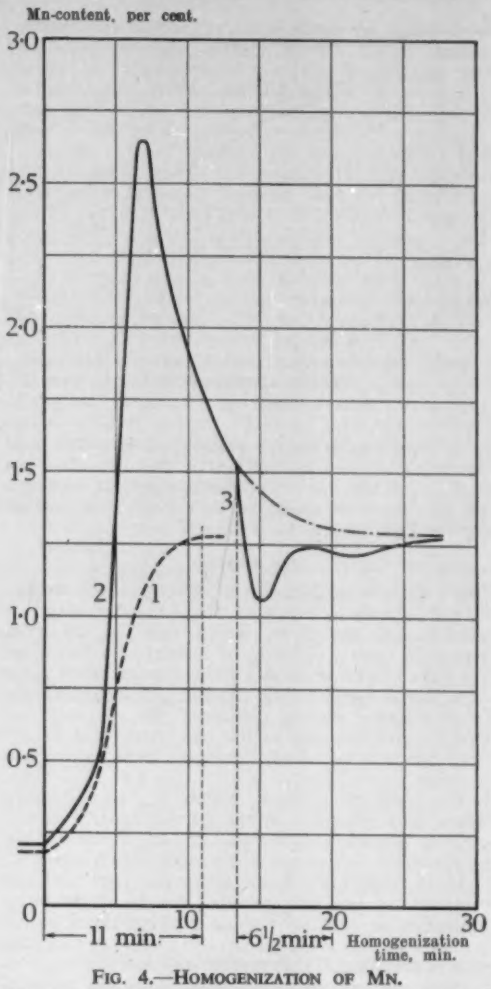


FIG. 4.—HOMOGENIZATION OF MN.
1—Average value of three stirred heats; 2—Stirrer switched off; 3—Stirrer switch on.

melts (C=0.16 per cent.). The positive influence upon the oxygen content has also been observed by, for example, Timken[5] and at Avesta.

Mannesmann[7] too indicates lower and more uniform values.

Reduction of Chromium Oxide.—In the process for making stainless steel out of scrap, about one third of the chromium content is oxidized during the oxygen blowing and, as is well known, can be reduced from the slag by adding FeSi:

$$3\,Si + 2\,Cr_2O_3 = 3\,SiO_2 + 4\,Cr.$$

Without stirring, the concentration of Si in the contact surface will rapidly become low and that of Cr high, resulting in a very slow conversion. The application of inductive stirring has here resulted

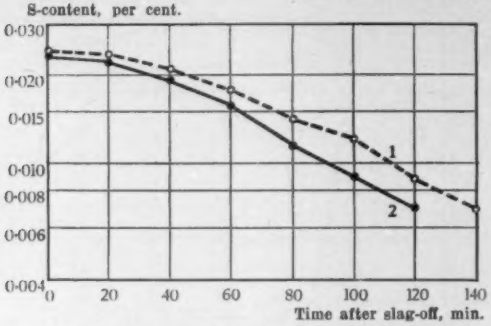


FIG. 6.—DESULPHURIZATION DURING THE REDUCING PERIOD. (SURAHAMMAR.).
1—Without stirrer; 2—With stirrer.

in a considerable improvement and is today used by many steelworks instead of the laborious reladling process. A thorough comparison between the two methods would be very interesting, but no figures are available at present.

Deslagging

Stirring the melt causes a movement on the surface, as shown in Fig. 1 *b*. Thus the slag is drawn around all the time, which can be observed especially clearly if pieces of lime are thrown upon the naked bath or upon a fluid slag, or when parts of a more viscous slag remain. By selecting the most suitable stirring direction, the operator can easily move the slag to the neighbourhood of the door and it is then only necessary for him to draw it out.

The deslagging work, which is normally very heavy and laborious in the intense heat, is consequently considerably facilitated and, therefore, the steelworkers accept the stirrer with enthusiasm.

More important, however, is the fact that the removal of the slag mostly can be done more efficiently so that no residue of an oxidizing slag remains in the furnace when the following reducing slag is prepared. This results in a low phosphorus content and an increased basicity of the reduced slag. SAFE[6], for example, consider it impossible to achieve the same quality without using a stirrer and indicate that this is especially valuable when working in duplex with basic-Bessemer and arc furnaces.

Other steelworks, for example Timken in the US (20 ft.=600-cm. furnace) and Samuel Fox & Company, Limited, in Sheffield (19 ft.=580-cm. furnace), are also satisfied with the lower phosphorus contents and the fact that the work at the furnace has become less arduous.

Impurities

The effective removal of the oxidizing slag also results in fewer oxide inclusions. Hagfors[3], for example, obtained the same or a better result in this respect with the stirrer on a 15-ton melt of 100 per cent. scrap with one deslagging than previously without a stirrer on a melt of 50 per cent. scrap with three deslaggings.

Due to good desulphurization, the sulphide inclusions have been reduced and their amount controlled more consistently (SAFE, Timken).

Saving in Time

Furnace time can be saved in many ways: (*a*) During melting-down, in that the stirrer makes the temperature more uniform throughout the bath, when most of the metal is molten but some pieces remain. This is especially the case in larger furnaces. Lumps sticking to the walls or the bottom are drawn into the melt; (*b*) during boiling, when low carbon contents are desired and also through a more even start of the boil; (*c*) during deslagging, especially when complete removal of the slag is desired; and (*d*) during the reduction period through faster reactions and less waiting time for the distribution of additions.

To estimate the real gain in time is, however, difficult, because the quality factor comes into the picture. When choosing between quality and time, most steelworks prefer to improve the quality and to consider the saving in time as of secondary importance.

In many places the furnace programme or the composition of the charge has been modified also for other reasons than the stirrer, so that a comparison between the furnace times before and after the installation of the stirrer cannot be made without a critical examination of the figures given in the production reports. It may, however, be interesting to study some examples:

In the 17-ft. furnace at SAFE two 7-month periods with and without the stirrer were com-

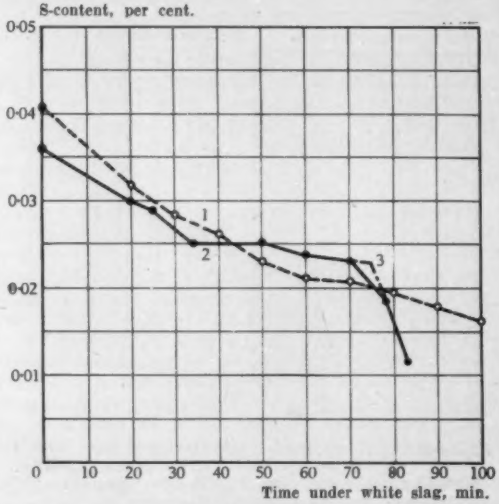


FIG. 7.—ACCELERATION OF DESULPHURIZATION WITH THE STIRRER.
1—Average curve for melt without stirrer; 2—Melt No. 5439; 3—Stirrer switched on.

pared[6], resulting in an average total saving of between 6 and 19 min./heat, depending on the quality. In a time study of the deslagging itself they obtained 7-13 min. on stirred heats and 10-15 min. on unstirred ones, thus giving a gain of only about 2 min.

It is remarked, however, that for the same quality of deslagging the real saving would have been about 5 min. more, as in that case it would have been necessary to have changed the rabble.

In a comparison between the making of stainless steel with the stirrer (Avesta, 40-ton charge) and with reladling, a time saving of at least 15 min. for the reladling operation and 15 min. for the reduction of sulphur and waiting for homogenization can be estimated, resulting in a minimum saving of 30 min.

In the old 7-ton furnace at Surahammar a refining time of 150 min. was necessary in spite of vigorous stirring by hand when making steel with very low S for electrical machines. In the new 10-ton furnace, which today is charged with 18 tons, the refining time with the stirrer is only 60 min., which means a saving of 90 min., in spite of better quality and doubled charge weight.

A smaller part of this time saving is, of course, attributed to a more modern furnace, but most of it must be attributed to the stirrer, say, at least 50 min.

Economy

When judging the profitability of a stirrer, the cost of purchase and installation, together with operating costs, must be compared with the gain. The installation costs are dependent upon local conditions and especially the design of the furnace in question. The bottom of this must be of austenitic steel and there must be space enough under the furnace for erection.

Many new furnaces today are built with a non-magnetic bottom and a stirrer installation is planned from the beginning. This is, of course, to be preferred, but as a rule it is possible to equip old furnaces too with a stirrer without meeting any great difficulties when changing the bottom plate.

Maintenance is simple, as the whole equipment consists only of a converter, a low-frequency generating device with a robust regulating system, an operating panel, pumps and some auxiliary apparatus. The main operating cost is thus the power consumption, which normally varies between 10 and 20 kWhr./ton produced.

When calculating the gain, the following possibilities of saving furnace costs should be taken into consideration: Reduced furnace time; cheaper scrap (*e.g.*, higher sulphur content); cheaper alloys (*e.g.*, higher sulphur content); possibilities of making steel of higher quality; saving of alloy elements due to accurate samples; better yield of steel and alloys; less rejects due to even analyses and a uniform tapping temperature; and increased charge weight with the same furnace time for reduction and homogenization.

Most of these advantages are more pronounced as the size of the furnace increases, due to the greater difficulties in controlling the bath composition. In very small furnaces it is also possible to get a homogeneous product by stirring with rabbles, even if this method can never work continuously during the process as the induction stirrer does.

As the relation between the diameter of the bath and the thickness of the bottom lining is more unfavourable for small furnaces than for larger ones, the required stirring power, in kVA, is almost the same for small and medium-sized furnaces. Thus the same generating equipment must be used for a steel furnace with a shell diameter of 8 ft. as for 19 ft. Consequently, the price of the stirring equipment compared with that of the furnace itself will be less favourable for smaller furnaces.

It is, of course, possible to connect two or more stirrers to the same generating equipment, and in this case two can be run simultaneously at a somewhat reduced power. This is, however, sufficient for most equalizing processes during the reduction period, but when full stirring power is required, *e.g.*, during deslagging or after the addition of some alloy elements, the appropriate stirrer can be connected alone. The additional price for such an extra stirrer is, of course, more favourable.

Modern stirrer equipments enable the stirring force and direction to be regulated very simply

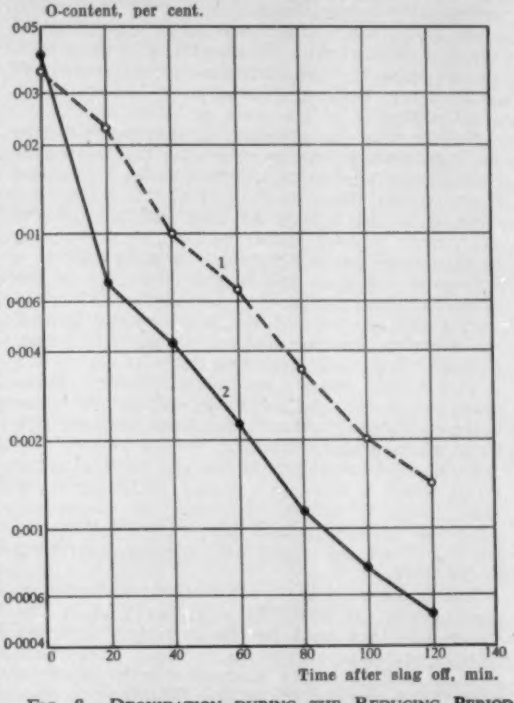


FIG. 8.—DEOXIDATION DURING THE REDUCING PERIOD C=0.15-0.24 PER CENT. (SURAHAMMAR.)
1—Without stirrer; 2—With stirrer.

and continuously from the operating panel. It is also possible to overload the equipment for 15 min. so that the stirring force is increased by 60 per cent. This is valuable for special mixing purposes and gives the metallurgist good possibilities for experimenting.

From the above, it is evident that a stirrer installation for a single small furnace is rather expensive and, as a general rule, stirrers are adopted on small furnaces only when they are used for special steels and not smaller than about 370 cm. inner shell diameter. For arc furnaces working on the production of other and even more expensive metals the situation is, of course, different.

Although it is difficult to make a complete calculation of the gain with a stirrer, it may be interesting to see some figures from stirrers in operation exemplifying the points given above.

SAFE[6] state that in their 15-ft. furnace an assumed saving of 10 min./heat on three heats per working day should pay for the stirrer in three years and three months, calculated on the mean fabrication cost of Fr. 14,000/ton. No account has been taken of the indirect advantages, as, for example, the fact that the rejects on a ball-bearing steel have decreased by several per cent.

The rejects at Timken have also been reduced, and it is stated in a report that: "The accurate temperature control and lower sulphur contents have thus given an improvement in the surface of the semi-finished steel that may result in an increase of as much as 4 per cent. in shipped weight of finished steel because of lower scrap losses and less conditioning."

Surahammar have made an investigation into their production reports regarding the making of transformer steel in an old furnace of 7 tons and their modern one of 10 tons (12 ft.=370 cm.) charged to 18 tons. At least 50 min. of the decreased refining time of 90 min. can be attributed to the stirrer, which is equivalent to a saving of 145 units per year, if the price of the stirrer represents 100 units. The stirrer is also used during the last part of the melting-down period, which means that the boil can be started 10 min. earlier without risk of surging out.

This should mean a saving of 30 units. However, only 15 will be included here, as this is the value of the weight that would have been lost if a surge out had been permitted.

Further, the furnace is charged with cheaper scrap, which is equal to a saving of 250 units per year. Some of this is, of course, also dependent upon the modern furnace and improved methods, but at least 60 units should be attributed to the stirrer.

The saving resulting from these three factors is, consequently, at least 220 units per year. The stirrer has thus paid for itself in less than six months, excluding all other advantages. The value of these in high-quality production is, however, so great that Surahammar consider the stirrer to be a very good economic investment.

According to Fig. 5, a saving of some tenths of 1 per cent. of the alloying metals is quite possible. In a 17-ft. furnace with an assumed production of 30,000 tons of stainless steel per year, a tenth of a per cent. would mean a yearly saving of 30 tons each of Cr, Ni and Mo. This represents a value of 210 units, if the stirrer purchasing price is set at 100 units. It was mentioned above that the time saved due to the stirrer in the same furnace was at least 30 min./heat, representing a value of another 30 units per year.

At a well-known US foundry making low alloy steels the following savings were estimated during the first year with an equipment including two stirrers, one for an 11-ft. furnace charged with 12·5 tons, and the other for a 13-ft. furnace charged with 25 tons, the total purchasing price being set at 100 units: due to lower consumption of alloys and use of cheaper scrap, 55 units; due to less rejects, 57 units; total, 112 units. This annual saving thus amounts to more than the price paid for the stirrers.

Lining Wear

A possible drawback of the stirrer is that it might cause some increase in lining wear. This is partly due to erosion resulting from the metal flow against the bottom and the walls, but probably to a greater extent caused by the fact that the bottom bricks are exposed to a higher temperature than without the stirrer, when the temperature gradient in the bath is considerable. This assumption is based upon the fact that, in most furnaces working with normal temperatures, no, or only very little, increase in the wear of the lining is observed when the stirrer is operated in the right way.

In Surahammar, for example, the difference in the consumption of patching materials between the furnace with stirrer and another furnace is within the range of production-report errors. Both the furnaces are of the same size, but the one without stirrer is used for a different melting programme. SAFE have observed no unfavourable influence of the stirrer upon the lining, provided that it is not used during the time of active working with ore[4] and Timken say that when the melting personnel had become familiar with the new operating characteristics of the furnace and the stirrer "there was very little erosion other than what is experienced in conventional furnaces."[5]

Under normal conditioning, there is consequently no reason to fear a significant increase in the wear of the lining, but there is, of course, no sense in using a stirring force greater than is necessary for the period in question. The magnitude of this force must be ascertained empirically and general recommendations only can be given. This is why the modern equipments are designed with very simple means of continuously adjusting the stirring power.

When working with very high temperatures, however, such as 1,700-1,800 deg. C. after oxygen blowing when making stainless steel, the flow of hot metal will cause an increase in the wear that is dependent upon the stirring force. When dis-

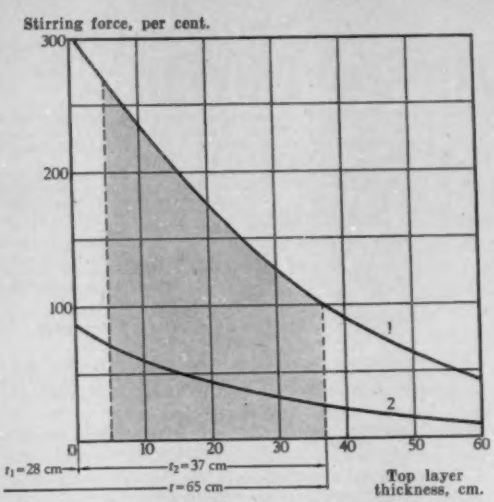


FIG. 9.—STIRRING FORCE AS A FUNCTION OF THE THICKNESS OF THE BOTTOM LINING. THE SHADED PORTION SHOWS THE PERMISSIBLE VARIATION IN THICKNESS OF THE TOP LAYER.

t—Total lining thickness; t_1—Bottom layer thickness; t_2—Top layer thickness.

1—Constant current 500 A; stirring force=100 per cent. with total lining thickness=65 cm. 2—Constant current 250 A.

cussing homogenization, it was mentioned, as an example, that the stirring current in a 13-ft (400-cm.) furnace at Hagfors was increased from 250 to 500 A. This resulted in the average bottom life being reduced by about 20 per cent. The set currents were, however, kept constant during the whole lining life and thus the stirring force was considerably higher than necessary when the bottom lining was thinner. The force increased to about 250 per cent. as can be seen from Fig. 9, where 100 per cent. corresponds to the required force that is reached at 500 A and 65-cm. lining. The stirrer currents are now adjusted as the bottom thickness decreases so that the stirring force is kept constant all the time. The wear caused by the stirrer is in this way reduced to a minimum, but no figures of the average life in number of charges are yet available. At this juncture, it is worth mentioning that the slag line should also be kept under observation, as the lining here will be subject to wear while the slag, which is moving all the time, is reactive.

On the other hand, an example can be given where the stirrer has increased the life of the lining. When blowing with oxygen in the making of stainless steel in their 40-ton furnace, Avesta observed cavitations in the bottom under the blowing pipe. They tried then to work with the stirrer at the same time and found that the wear was equalized over the bottom and the total life in number of charges increased.

Other Applications

The induction stirrer is, of course, not limited to the arc furnace even if it has been used up to now only in conjunction with this type of furnace. It is, however, suitable for all kinds of container with a molten metal for processes where moderate stirring is desired. The melt must, however, be an electric conductor.

Among other interesting applications the stirring of iron in ladles may be mentioned. This has been discussed specially in connection with an already existing stirring equipment for an arc furnace and an extra stirrer would then be used for stirring the steel in the ladle, *e.g.*, during vacuum treatment. For large open-hearth furnaces, too, a stirrer could be a good investment, but the construction beams under the furnace generally make such an installation very complicated.

Ladles or containers with pig-iron for desulphurization are another example. The stirring of aluminium during remelting is also of considerable interest.

Summary

During the first 10 years of practical experience with induction stirrers, nearly 40 arc furnaces have been equipped with these stirrers and the results since the preliminary trials have been very satisfactory. Several illustrative examples are given in this survey. They show that the homogeneity of the bath is much better than without stirrer, resulting in representative samples, saving of alloy elements, and more accurate temperature measurement; chemical reactions between steel and slag are speeded up and can proceed closer to the theoretical equilibrium, the S and O contents of the steel being kept at a low and uniform level; deslagging is considerably simplified, and is carried out more easily and efficiently with the stirrer, and impurities in the steel are reduced.

The reduction in operation times, improvement of quality and saving of alloy elements prove that a stirrer installation is an unusually good investment which pays for itself in a very short time. This is confirmed by the fact that many steelworks have ordered additional stirrers after their experience with their first equipment.

The induction stirrer is thus a good tool for the metallurgist and offers him the possibility of much better control of operational techniques in the manufacture of steel in the electric-arc furnace.

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[2] Dreyfus, L., Nilsson, F., "Induktiv omröring i ljusbagsugnar" (Inductive Stirring in Arc Furnaces). *Jernkontorets Annaler*, **133**, (1949), pp. 371-468.

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[6] Duflot, Porcheray, "Brassage électromagnétique. Application la désulfuration." *Revue de Metallurgie*, **52** (1955), 4. (Summarized in IRON AND COAL TRADES REVIEW, December 9, 1955.)

[7] Speith, v. Emde, Schneider-Milo, "Die Wirkung einer Elektroinduktiven Badbewegung auf die Metallurgischen Reaktionen im Lichtbogenofen." *Stahl und Eisen*, **78** (1958), 4, pp. 215-223.

FORTHCOMING EVENTS

FEBRUARY 6

North of England Institute of Mining and Mechanical Engineers: Meeting in the institute lecture theatre, Neville Hall, Newcastle-upon-Tyne, at 2.30 p.m.: "Prop-load Measurements Underground," by J. D. Jenkins and I. Storey, and adjourned discussion on "Layering of Firedamp in Longwall Workings," by E. J. Raine.

FEBRUARY 8

Lincolnshire Iron and Steel Institute: Meeting at the North Lindsey Technical College, Scunthorpe, at 7.30 p.m.: "Special Steel Production," by F. C. Martin.

FEBRUARY 10

North Wales Metallurgical Society: Meeting in the lecture theatre, Flintshire Technical College, Connah's Quay, nr. Chester, at 7 p.m.: "Prospects for the Continuous Casting of Tonnage Steel," by J. Savage.

Institute of Metals: Meeting at the institute headquarters, 17, Belgrave Square, London, S.W.1: "Solidification of Alloys," by W. C. Winegard.

Institution of Plant Engineers (Dundee Branch): Meeting at Taypark Hotel, West Ferry, at 7.30 p.m.: "Uses of Aluminium in Engineering.

FEBRUARY 11

Combustion Engineering Association: Meeting at St. Ermin's Hotel, London, S.W.1, at 10.30 a.m.: "Work of the British Coal Utilisation Association Towards Improving Mechanization and Automatic Control in Industrial Coal-fired Boiler Houses," by G. G. Thurlow.

Institution of Mechanical Engineers (East Midlands Branch): Meeting at the Technical College, Chesterfield, at 7.15 p.m.: "Future Trends in Coal-mining Machinery," by J. R. Ashley.

Manchester Geological and Mining Society: Meeting at the Wigan and District Mining and Technical College, at 4 p.m.: "Experiments with Roadway Supports," by J. G. Hind.

Society of Chemical Industry (Corrosion Group): Joint meeting with the Liverpool Section, Liverpool Metallurgical Society, and College Scientific Society, at the College of Technology, Byrom Street, Liverpool, at 7.30 p.m.: "Recent Research on the Corrosion and Protection of Iron and Steel," by J. C. Hudson.

FEBRUARY 12

Normanton, Castleford and District Mining Society: Meeting at the Whitwood Technical College, Castleford, at 7 p.m.: "Manpower Saving Devices," by S. C. Walker.

Southern Counties Institute of Mining Engineers: Meeting at the headquarters of the Institution of Mining Engineers, London, S.W.1: "Contributions of Metallurgy to the Coal-mining Industry," by A. Latin.

Manchester Association of Engineers: Meeting at the Engineers' Club, Albert Square, at 6.45 p.m.: "Future of Coal Preparation," by J. E. Chick.

FEBRUARY 15

Royal Society of Arts: Meeting at the society headquarters, John Adam Street, London, W.C.2, at 6 p.m.: "World and National Energy Resources," the first of three Cantor lectures entitled "The Fuel and Power Industries and National Prosperity," by A. Parker.

Institution of Electrical Engineers (Sheffield Sub-Centre): Meeting at the Angel Hotel, Brigg, at 6.45 p.m.: "DC Winder Drives using Mercury-arc Rectifier/Inverters," by L. Abram, J. P. McBreen, and J. Sherlock.

FEBRUARY 17

Midland Counties Institution of Engineers: Meeting at the Mines Rescue Station, Mansfield Woodhouse: "Development of an Experimental Ripping Machine," by C. V. Peake.

Mining Institute of Scotland: Meeting at the Royal College of Science and Technology, Glasgow: "Coal Clearance Underground," by H. H. Wilson.

FEBRUARY 18

Institution of Plant Engineers (Blackburn Branch): Meeting at the Castle Hotel, at 7.30 p.m.: "Some Experiences with Chemical Engineering Plant," by J. C. Veale.

FEBRUARY 19

West of Scotland Iron and Steel Institute: Meeting at 39, Elmbank Crescent, Glasgow: "Application of Electron Microscopy in Steel Research," by F. B. Pickering.

FEBRUARY 22

Royal Society of Arts: Meeting at the society headquarters, John Adam Street, London, W.C.2, at 6 p.m.: "Production and Treatment of Coals and Oils," the second of three Cantor lectures entitled "The Fuel and Power Industries and National Prosperity," by A. Parker.

Institution of Plant Engineers (Birmingham Branch): Meeting at the Hotel Leofric, Coventry, at 7.30 p.m.: "Modern Welding Methods," by R. T. Andrews.

FEBRUARY 23

Combustion Engineering Association (North-Western Region): Meeting at the Engineers' Club, Albert Square, Manchester, at 2.30 p.m.: "Refractories for Kilns and Furnaces," by N. W. Hinchliffe.

FEBRUARY 25

Coke Oven Managers' Association (Northern Section): Meeting at the Three Tuns Hotel, Durham, at 7 p.m.: "Improvement of Coke Quality," by D. A. Hall and J. Gordon.

Society of Instrument Technology (Chester Section): Meeting in the premises of the English Speaking Union, Watergate Street, at 7 p.m.: "Automatic Control of Steel-rolling Mills," by W. N. Jenkins.

FEBRUARY 29

Royal Society of Arts: Meeting at the society headquarters, John Adam Street, London, W.C.2, at 6 p.m.: "Natural and Manufactured Gas," the last of three Cantor lectures entitled "The Fuel and Power Industries and National Prosperity," by A. Parker.

National Association of Colliery Managers

FEBRUARY 9

Yorkshire Branch: Meeting at the Miners' Welfare Hall, Brodsworth, at 3 p.m.: "Solid Stowing on a Mechanized Face at Wharncliffe Silkstone Colliery," by E. E. Crankshaw.

FEBRUARY 15

Midland Branch: Meeting at the Denman's Head, Sutton-in-Ashfield. Paper by N. Siddall.

FEBRUARY 24

Lancashire Branch: Meeting at the offices of the North-Western Divisional Board, Manchester, at 4 p.m.: "Recent Experiences of Caving in the St. Helens Area," by J. Abbott.

FEBRUARY 26

Kent Branch: Meeting at the Swan Hotel, Deal, at 7.15 p.m.: "Some Recent Developments in Underground Mechanization," by A. G. Douthwaite.

New Equipment

General Purpose Saw

MOST saws are designed to cut certain materials only. A saw which has been needed for years is one that will cut, easily and quickly, both wood and metal and other materials too—a "general purpose" saw, in fact.

James Neill & Company (Sheffield), Limited, has now produced the "Eclipse" No. 66 general purpose saw. It has a 16-in. long tungsten-steel blade which is specially tapered to facilitate sawing in confined spaces; moreover, the blade can be quickly positioned and locked at any one of nine different angles relative to the handle, a feature which makes the saw ideal for cutting materials in awkward positions. The blade clamping screw and wing nut cannot be separated and, therefore, cannot be misplaced or lost.

The "Eclipse" general purpose saw will cut easily such materials as hard and soft wood, wood in which nails or bolts are embedded, hard rubber, plastics, fibreboard, and small tubes and bars made from mild steel, copper, brass, aluminium, lead and the like. The blade is hard wearing, but when it does have to be replaced a new blade can be fitted in a few seconds.

There are many occasions when it would be a great help to be able to pick up just one saw which will act in almost any position and will do the "odd sawing job," irrespective of whether the material is metal, wood, or plastic, etc. It is on these occasions that the usefulness of the "Eclipse" general purpose saw is most obvious and its value most appreciated.

Modernization in Hungarian Mines

Ozd Coal Mining Trust, in northern Hungary, has spent about £2,000,000 on the modernization of mine equipment and structures in the area. A new coal-screening plant has been built at the Szarvaskö collieries, which supply coal to the northern town of Eger.

REPORT ON MINING EXPLOSIONS

Sir Andrew Bryan at Newcastle Meeting

SIR ANDREW BRYAN, introducing the Report of the Sub-committee on Mining Explosions for discussion by a joint meeting of the North of England Branch of the National Association of Colliery Managers and the North of England Institute of Mining and Mechanical Engineers on October 23, 1959, recalled that the sub-committee was set up towards the end of 1957 by the Safety and Health Committee of the Coal Industry National Consultative Council. An account of its report appeared in IRON AND COAL, October 2, 1959, p. 477.

The sub-committee, over which Sir Andrew presided, was representative of the five constituent parties to the CINCC, and consisted of members of the National Union of Mineworkers, National Association of Colliery Overmen, Deputies and Shotfirers, British Association of Colliery Management, National Association of Colliery Managers, and the National Coal Board. The Minister of Power was represented by the Chief Inspector of Mines, acting as assessor.

An alarming run of explosions, several apparently with features in common, giving rise to great concern, led to the setting up of the sub-committee. Its terms of reference said Sir Andrew, were to consider the explosions as a whole, to report upon the lessons to be learned from them, the steps to be taken to prevent further recurrences and the measures to be taken to bring the findings of the committee to all concerned. The sub-committee considered 13 explosions, seven of which occurred in 1957, and submitted its report in February, 1959.

Causes of Explosions

From all the available reports on each of the incidents, Sir Andrew had prepared a statement on each incident, setting out what he regarded as the important points for discussion. The statements also indicated the fundamental weaknesses and primary causes in each case, as well as the matters that would probably require attention if similar happenings were to be prevented in future. These statements formed a starting point for the sub-committee's discussions, and were considerably amended and extended as a result of the contributions of the various members.

The report was unanimous and was perhaps unusual in that it made no attempt to apportion blame and place responsibility upon individuals. The report was also unusual in that it did not recommend additional statutory regulations, the committee considering the existing regulations adequate if properly carried out.

A review of ventilation practice in relation to most of the incidents revealed features which, seen in the light of after events, could not be regarded as good practice. The committee suggested that pre-requisites to sound ventilation practice were: (1) In planning a method of working due regard should be paid to the ventilation of the workings; (2) there should be a project ventilation plan, and the ventilation system should not be the result of expedients progressively adopted as the workings advanced; (3) each underground official should be conversant with the overall ventilation plan for the colliery, as well as for his own particular part of the mine; (4) ventilation should be included among the items covered by the development plans agreed and signed by mine management and specialist engineers, these items not subsequently being altered in any major respect without the agreement of the signatories; and (5) a project ventilation plan should incorporate arrangements to be adopted at each stage of a development. This plan should be properly considered and phased and should be familiar to and understood by the officials who had a statutory responsibility for the ventilation of the development concerned.

Changes in Ventilation Arrangements

Sir Andrew said changes in ventilation arrangements were sometimes inevitable; as development progressed, plans had sometimes to be modified. Changes of a major character should be made, except in emergency, only after careful consideration by, and with the approval of, mine management and the appropriate specialists. Changes once agreed upon should be made known to the appropriate mine officials from the deputy upwards. It was not enough merely to acquaint the officials in the districts where the actual changes were made if the alterations affected the quantity of air circulating in other districts. It should be axiomatic that the ventilation plans should be as well-known and as carefully followed as the plans for the extraction of coal and, further, that haphazard changes in ventilation plans or systems had no proper place in mining today.

Most of the primary causes of the incidents covered in the report were well known. Much in evidence were old familiar hazards and faulty practices relating to such matters as local accumulations of gas, faulty coursing of air, leakage, strata support and control, care and maintenance of equipment, shotfiring, contraband, and human behaviour. None of the immediate causes or predisposing factors to any of the incidents was wholly unknown. There were, however, a few which were either not known to, or the significance of which was not sufficiently appreciated by responsible officials on the spot. Some of these factors were common to more than one explosion.

Danger from thin Layers of Gas

This was true, for example, in respect of the potential danger from thin layers of gas near the roof in high roadways. The fact was that such layers could escape detection even by careful deputies and officials using the ordinary everyday and accepted methods of gas detection. Although the quantity of gas in a thin layer might be very small, no one should forget that

it could lead a trail to a bigger accumulation in a waste, a break, a bed separation cavity, a dead-end or fast corner. The fact that thin layers of gas, or small accumulations in cavities could readily and quickly be brought down by a fall of roof and get so well mixed with air in the process as to be readily ignitable even at floor level, was certainly not well enough known; nor was the fact that a thin layer of gas was capable of backing up against the normal roadway ventilation current. This was something that ought to be far better known than it had been in the past.

Inflammable gas would never be prevented from escaping into the mine atmosphere so long as deep coal was mined, nor would it be possible to stop some of the coal dust formed in coal getting from being dispersed into mine roadways. However, it might be possible to minimize the quantity of gas and dust by proper use of efficient methods of gas drainage and dust suppression. Also, freedom from inflammable gas in "open-light mines," and freedom from dangerous coal dust in wet or damp mines, could not be taken for granted. Nor would it always be possible to prevent electric cables and equipment from being damaged, ventilation systems or machines from breaking down, airways from becoming constricted or blocked, or rocks from falling and creating hot spots, frictional or incendive sparks.

It was thus clear that it was not possible to make everything foolproof or to attain intrinsic safety in relation to explosions. Safety could not be taken for granted. Wherever practicable, proper use must be made of known safety methods and precautions. Fortunately, accumulations of inflammable gas rarely occurred simultaneously with an actual source of ignition in the same place.

Local Accumulations of Gas

Recent experience showed that explosions rarely originated from the ignition of inflammable gas present in the general body of the air current circulating through the main airways of a mine, but more often started from the ignition of small local accumulations in places which, all too often, were not well swept by the ventilation current. It was important to remember that it was not enough to provide a quantity of air adequate for the mine as a whole; care must be taken to ensure proper coursing of the air to all the vulnerable spots so that the ventilation was good locally as well as generally.

For many years now, ventilation in the general sense had been relatively easy because there was usually plenty of power available to drive the large fans that caused sufficient air to flow through the large airways of the modern mine to keep the workings sweet and wholesome. Nevertheless, good general ventilation was not enough; there must also be good local ventilation which was not always easy and which often required special efforts to provide and maintain.

It was well to remember that nearly all explosions of a more or less major character demanded the coincidence of three main contributory factors: a source of ignition, a local accumulation of inflammable gas, and conditions favourable to the spread of the explosion. If reasonable care and attention were given to the well-known safeguards and precautions then the chances of the occurrence of all three factors, or even of any two, at one time and place should be so extremely remote as to make explosions almost things of the past.

One important factor that emerged and one which Sir Andrew felt the sub-committee would like him to stress, was the way in which small rates of gas emission—rates that seemed quite trifling when quantified—could, in circumstances by no means rare, build up into dangerous concentrations, or form thin layers giving a continuous train back to a larger concentration elsewhere. An important complementary aspect was the danger represented by local concentrations of gas which collected at vulnerable points without having any readily perceptible effect on the general ventilation. It was important, therefore, to make careful tests for gas in these vulnerable places, *e.g.*, ripping lips, high places, roof cavities, waste edges and fast ends where gas was likely to accumulate.

Care must also be taken to see that what at first sight appeared to be quite satisfactory percentages of gas in statutory air samples taken in the general body of the air in an airway were not allowed to induce a false sense of security about local conditions elsewhere. Even quite a small increase in the relatively small gas content of successive air samples taken from the general body of the air in a return airway might be significant since it could have an effect locally which was much greater than the amount of the increase would seem to suggest.

Margin of Safety in Ventilation

An important objective in ventilation, and one that could not be over-emphasized, was to have and maintain a sufficient margin in the quantity of air circulating through a mine or district of a mine to enable the ventilating current to cope with the rates of increase in gas emission that occurred from time to time due to such causes as a fall of roof in a waste or a falling barometer. Management should try to avoid being in the position of having to operate a ventilation system which was already so fully extended that there was no factor of safety to meet such ordinary contingencies.

On gas detection, the sub-committee concluded that the main device for routine daily testing of the mine atmosphere by on-the-spot officials must remain the flame safety lamp. However, it needed to be redesigned and adapted to enable it to be used for detecting thin layers of gas against a roof and for being raised into high places which were ordinarily inaccessible without a ladder or other means of access; the emphasis in the further development should be on its use as a gas detector and not as a source of light. Further improvements and developments were needed in relighter flame-safety lamps to make them both safer in use and lighter in weight, and to encourage better compliance with the detector regulations through a more extended use by workmen. Further developments were also recommended in respect of automatic gas detectors for the making of routine ventilation checks and for use in special or vulnerable places.

The sub-committee also recommended more intensive research and investigation in the laboratory and in the pit into the problems of preventing, detecting and dispersing and accumulations of gas, and especially in relation to thin layers next the roof of high roadways of large cross-sectional areas. There was room here for properly supervised and controlled pit trials to arrive at the best practical means of dealing with these problems. A good deal more practical experience of ways of dealing with these problems was necessary before any hard and fast rules could be laid down.

Stress was laid in the report on the important part good strata control and support played in the prevention of explosions and especially the need for taking appropriate steps to avoid danger from "first weighting" in the opening out of new longwall faces and to prevent the formation of roof cavities. In relation to both of these matters it was essential at least to ensure the prompt and proper setting, in accordance with

agreed plans, of supports having a high degree of stability. Stability in the supports structure of roadways was of paramount importance in preventing the formation of cavities. Steel-arch supports should always be properly strutted and, where necessary, lagged, preferably with fire-resistant material. Dealing with a large roof cavity could at times be difficult and in some instances it might become necessary to stop other work until the cavity had been given proper attention.

While coal dust played little or no part in most of the explosions there were two instances where coal dust, which was damp and seemingly indispersable, played a part in propagating the explosions. With these cases in mind, and having regard to the results of recent research in Poland relating to the propagation of explosions by wet coal dust, results which were brought to the notice of the sub-committee, the report suggested that the evidence now available on this subject should be considered by a small expert committee with a view to guidance being given to management on the safe way of dealing with this damp-dust problem.

Regarding the care and maintenance of underground equipment, the report directed attention to the good design of machines and, where a choice was available, of siting underground machinery and equipment as safely as possible, because there were instances where the source of ignition was incendive sparking due to damage to live electrical apparatus by falls of ground. There was a need for more care to be taken to ensure the safety of cables; in a shotfiring zone, protection should not be a matter of makeshift arrangements. There was also room for improvement in the standards of practice of workmen and officials alike. This was particularly true of shotfiring practice in drifts where large rounds of shots were fired by high-capacity exploders which could not yet be made intrinsically safe. The sub-committee hoped that the guidance given recently by the NCB on shotfiring practice in stone drifts and like places would receive proper attention.

The Human Factor

Perhaps the most important factor stressed in the report was the human factor. Safety was everybody's business but the heaviest responsibility rested with officials and management. Sir Andrew thought the basis of safety from the explosions, as indeed from most other accidents, lay in everyone behaving in a responsible manner and doing whatever job was to be done in a conscientious and workmanlike way.

The fact that the vast majority of accidents were avoidable by ordinary caution did not necessarily mean that they were all due to a deliberate disregard of safety precautions, of good practice or, indeed, to an abnormal sense of recklessness on the part of one or other of the victims. Sir Andrew was more worried by the general *attitude* towards safety of some of the persons concerned rather than by their actual behaviour. It was not that they did not know; they were just indifferent. Fortunately for them—and for the rest of us—they often got away with it. It was because of this very human tendency to indifference that so much responsibility for fostering and developing a safety attitude of mind rested upon management. In this matter leaders of the unions, as well as the professional associations, had a part to play. Officials at pits should remember, however, that the force of example in practice played a vital part in achieving greater safety.

Recent experience suggested that the less dangerous mines were, the greater was the apathy and indifference to safety. Certainly all the recent series of explosions occurred in mines not regarded as especially gassy, and it almost seemed that the chances of a major explosion were greater now in the relatively non-gassy than in the really gassy mines. This was certainly not as it should be. It should be much easier to make the less gassy mines safer from explosions than the more gassy ones.

The report, concluded Sir Andrew, stressed that the safety of a pit must largely depend upon the extent to which the individuals in it wanted it to be safe and were prepared to exert themselves to see that it was so. Without the active and full co-operation of management and men, no amount of safety equipment, legislation and codes of good conduct could succeed. Each must do his own job well and must be not only alive to, but also concerned to put right anything he happened to see in the course of his work that might affect safety. That way lay greater safety and greater freedom from explosions. The sooner they all realized their duty and responsibility in relation to safety, the sooner would they attain that measure of safety in mines that, deep down in their hearts, they all so much desired.

Discussion

MR. R. S. MCLAREN, president of the North of England Institute of Mining and Mechanical Engineers, after thanking Sir Andrew for his introduction of the report, said that it was worthwhile that the discussion should take the form of suggestions as to how the various recommendations, which particularly affected managers, group managers, Area and divisional staffs were to be implemented. The great weight of statutory regulations, board instructions and codes of practice, and these new recommendations, made it impossible for the average manager to attend to them all personally, and yet he had the responsibility. Means of delegation, supported by a suitable check system must be devised to ensure that the work was carried out properly. It was hoped that in the discussion this aspect of the matter would receive some attention.

MR. J. T. ROBSON drew attention to the fact that several explosions took place when a new face, moving off from the solid, suffered its "first weighting," and to the need for good roof control at this time, and to the build up of gas in the waste and some gas emission. He suggested that there should be at all times spare equipment such as drainage pipes, exhausters, etc., readily available on hand to deal with any gas which might build up in the waste.

SIR ANDREW BRYAN said he would not like to insist that all this equipment should be readily available at all times; the circumstances should be carefully studied and known. In a pit known to be gassy, clearly some of the equipment mentioned should be readily available. The sub-committee found a surprising number of cases where no additional precautions were taken to guard against the dangers of "first weighting." Constant attention had to be given to changing circumstances if reasonably safe conditions were to be obtained.

MR. F. A. MILLICAN voiced his interest in the human factor. In its report, the sub-committee said it did not think legislation was required to implement the recommendations, and therefore the human factor was going to play a great part in implementing the recommendations. He suggested that the practical man and the technical man should pool their ideas. In spite of all that had been done, the accident figures were not going down.

Attention was also drawn by MR. MILLICAN to the many explosions in Cumberland in the past and to the feeling in the minds of the men that they "were not

going to have any more electricity," with the result that compressed air was utilized. To get high productivity, electricity must be used, and unless the backing of the men and the trade union was obtained, it could not be successfully used in Cumberland.

SIR ANDREW BRYAN said he knew something of the history of Cumberland, in so far as explosions were concerned. He had personally been concerned with at least four of them which he agreed must have affected the outlook of the men. He felt, however, that it was a question of communicating the facts to the men and convincing them that what was being proposed was good, safe practice. But it was bound to take time. Memory of the past often warped present judgment. Compressed air could have dangers also, and more than one explosion had been attributed to its use.

Standards of Practice

MR. W. S. HUTTON spoke of Clause 57 of the report of the sub-committee regarding standards of practice. The co-operation of the professional institutions could be of great value in propagating a sense of the high status and responsibility of the colliery electricians' work. He enquired why men, apprenticed for three years, asked to be allowed to go on to shift work, or who went to jobs outside the industry, should want to leave, and he suggested that as the size of the deputies' districts was laid down, so also should those of the colliery electricians.

SIR ANDREW BRYAN agreed that it was just as important that the actual number of electricians, mechanics and others should be specified as it was to specify the actual machines that were going to be used. The installation of machinery should be accompanied by the requisite number of men to attend to it.

MR. WALKER mentioned the customary practice of suspending auxiliary fans and cables near the roof where gas was most likely to accumulate, and suggested that they should be suspended about 3 ft. from the floor at the roadway side. SIR ANDREW BRYAN replied that regard would have to be paid to local circumstances. If cables and fans were put near the roof they were clearly in a part where inflammable gas, if any, would collect; but it might be that traffic on the roadway would determine the height.

MR. J. S. RAINE suggested that there was much to learn with regard to gas layering. He mentioned that the velocity over a roadway was not uniform, but the maximum velocity was in a centre zone of perhaps 2 ft. from the ground, then it changed from the area to zero near the sides and particularly at the top. Where the velocities were low, the accumulation of methane was apt to occur if it was issuing from the strata, and he asked if there was any velocity, perhaps 100 ft./min., below which Sir Andrew thought air should move along the road nearer the outside or the surface of the road. MR. J. A. NIMMO, in a supplementary question, also asked what velocity was needed to move a very small layer of concentrated methane at the roof of a roadway.

SIR ANDREW BRYAN was not prepared to specify velocities. Much work, he said, needed to be done on this subject and it would be unwise to lay down velocities at the present time. In due course he hoped the NCB would issue guidance on these questions.

MR. TURNBULL asked if roadway junctions, especially arch girder junctions designed with a constant height width ratio to meet strata control requirements, should be included in the list of vulnerable points and also asked if Sir Andrew agreed that additional expenditure for implementing the recommendations was insignificant.

SIR ANDREW BRYAN, replying, said he thought that at roadway junctions turbulence was generally greater than in straight roadways and that factor might help in the prevention of accumulations. Regard must always be paid to the special circumstances of the particular part of the mine. He did not think the implementation of the sub-committee's recommendations would be a very costly matter.

MR. R. WILLIAMS asked if the sub-committee had any special hazard in mind when it recommended a manager consulting a specialist engineer concerning a fan installation. SIR ANDREW BRYAN said the sub-committee had no special hazard in mind, but thought managers would be well advised to consult the specialist about a fan installation.

MR. ROBINSON spoke of leakage gate faces, which were in two categories, the deliberate ones in the main tailgate and those where double-unit longwall faces were set away from rib sides and not completed because "first weighting" would destroy them. He asked if any leakage gate face could be properly ventilated in all cases. SIR ANDREW BRYAN replied that he could not answer the question satisfactorily without a knowledge of the circumstances of each case. He hoped no leakage gate face was being worked that was not properly ventilated.

MR. ROSS felt that following the report there would be an extended use of the methanometer which could be used in places regarded, at the moment, as inaccessible. SIR ANDREW BRYAN said accessibility had to be considered in a practical way. It should be the aim to take steps against any risk or hazard that might arise. It would be a good thing if something more was known of the atmospheric conditions in places immediately contiguous to a working place, even if these places were ordinarily inaccessible.

Testing for Firedamp

MR. W. WIDDAS, Divisional Inspector of Mines, Durham Division, spoke of the four explosions which occurred after the appointment of the sub-committee, and noted that two involved striking a match when coal dust played an anticipated part and felt that the sub-committee was right in drawing attention to the fact that coal dust could be raised in a cloud sufficient to cause an explosion. He deemed it essential that it should be possible to test for gas in the top of a roadway but stressed that firedamp was not the only gas an official must test for, which he thought significant in Durham, particularly in the shallow west pits.

Mr. Widdas asked for advice on the margin of ventilation to be maintained to provide for normal contingencies, gas emissions due to a waste fall or to a drop in the barometer, and on how to get the extra ventilation to deal with gas emission, whether the percentage of firedamp in the general body of the air should be considered, and whether it would be advisable to determine the actual quantities of gas and air in the ventilation current. Even a slight increase in the percentage of firedamp should be carefully investigated. He agreed that a safety lamp should be carried on all occasions during inspection. With regard to helping with propaganda in connection with explosion prevention, the inspectorate was willing and ready to help by talks to get this point over to the workmen, as one of the biggest difficulties has been to get over to the men the available facts and information and the remedies suggested.

SIR ANDREW BRYAN was sure that all concerned would welcome any assistance the inspectorate could give by way of talks and meetings. The report did not expect a quantity of air to be provided to deal with every abnormal condition that might arise, but it

did expect the provision of sufficient air to deal with ordinary contingencies. As to the margin need for this purpose, he thought officials with local knowledge and experience would have little difficulty in determining a satisfactory figure. Sir Andrew agreed it was not simply a matter of testing for firedamp alone; officials must know something about the oxygen and CO_2 content as well.

MR. N. BEANEY remarked that Sir Andrew had, in a talk on safety a few years ago, observed that the incidence of accidents often coincided with the incidence of unrest and wondered if this unrest factor among officials and deputies in the question of misdeeds, which came forward in lots of reports in regard to accidents, had been followed up. Everyone should carry their lamp all the time. Could not a smaller type of lamp be provided as with the large one now carried there was a temptation to leave it behind at the loading point? Mr. Beaney noted the open spaces often left above the lagging around arch girders, with the consequent danger of gas accumulation in the cavity.

SIR ANDREW BRYAN agreed that such cavities could constitute a danger; they should be prevented or be reasonably well filled. With regard to lamp design he thought it should be possible to provide a smaller, lighter, and more easily carried lamp. Regarding unrest, Sir Andrew was convinced that some indices such as rates of absenteeism, strikes, and accidents, gave some clue to the state of mind of persons working in a particular pit. Much could be done by investigation on matters of this kind. These indices, however, were not noted and followed up by the sub-committee, but he hoped it was a point that would be noted by safety engineers.

MR. W. D. HARRISON dealt with the question of contraband and agreed with the dismissal of any person deliberately carrying contraband, but thought it a vicious instruction to have to carry out when, through forgetfulness, contraband was carried. SIR ANDREW BRYAN stressed that in so far as the sub-committee was concerned the recommendation was "liability to dismissal" and not "dismissal." Due to the importance of this matter, the sub-committee felt that an interim recommendation relating to contraband should be made. It was, in fact, made long before the completion of the report. MR. R. WILLIAMS compared the manager's job now with that of years past and referred to the growing number of calls upon his time and to the need for delegation. In reply to MR. R. WILLIAMS, Sir Andrew said that no one would deny that pits required a great deal more attention today than formerly, and that the duties of officials were now much more specialized. There was a need for more officials and specialists, and he would like to see the manager with more time to sit and think during his working hours.

Statutory Regulations

MR. F. H. BAKER said that although the sub-committee was satisfied that there was no need to add to legislation, he thought some attention might be given to altering the law in one or two respects and asked if it would not be possible to lay down maximum distances for packs. He inquired whether it would not be better to modify the explosions regulations so that explosives should be in a locked canister and not in a closed canister and whether it would be better and proper in connection with the voluntary conversion of naked light to safety lamp mines to have an all-embracing set of regulations to enable the changeover from naked lights to safety lamps to be smoothly carried out.

SIR ANDREW BRYAN thought that in these matters the emphasis should be on the word "voluntary" and that statutory regulations were hardly needed. With regard to maximum distances of packs from the face, he thought it would be wrong and unwise to specify maximum distances and, regarding closed canisters, that it was a matter of common sense and interpreting the present regulations in the spirit rather than in the letter.

MR. W. HOLDING thought it was the duty of the manager to decide who should carry relighter lamps, although the report suggested that relighter lamps should be issued on a more liberal scale. SIR ANDREW BRYAN mentioned the difficulties that arose from having to get ordinary flame lamps relighted. The manager should decide who should carry relighter lamps but Sir Andrew hoped to see an extended use of them.

MR. W. HAZON drew attention to the human factor and suggested that the men, by talks, should be persuaded to report gas where found; some classes of workmen feared a loss of wages if they stopped to report gas to the deputy. He suggested that it would be a good thing to have explosions filmed for the NUM to show, in an effort to make the men understand the violence of explosions. SIR ANDREW BRYAN agreed that the attitude of the men towards safety was very important. It would be a great help if people would take the right attitude towards the ever-present sources of danger. He hoped there were very few cases where men were carrying on working when danger was indicated without drawing the attention of an official to it or without themselves doing something about it. Films had been made, including one relating to experimental work at Buxton in which attempts were made to simulate the actual conditions at some of the mines at the time a particular explosion happened. The sub-committee hoped that a number of films with appropriate commentaries would be shown at a number of centres in the coalfields to try to get the need for safety to all concerned.

MR. T. HALL, proposing a vote of thanks to Sir Andrew, said he had touched on the salient points of the report, which had provided a wonderful discussion, and he should have some very good points to put before the sub-committee from the North of England. Sir Andrew was assured that those present would do all in their power to supplement and implement the recommendations and would pass on the information to their under-officials and also to the workmen themselves.

New Catalogues, etc.

THE following new catalogues, booklets, etc., have been received and are acknowledged with thanks.

METAL INDUSTRIES, LIMITED, London, W.1—Booklet dealing with the company and its activities.

TULLOCH CONSTRUCTION COMPANY, LIMITED, London, E.C.4—Leaflet describing Tullcon wire rope terminals.

VICTOR PRODUCTS (WALLSEND), LIMITED—Leaflet No. L. 300, covering miniature fluorescent lighting fitting for two 12-in., 8-watt tubular lamps.

CROFTS (ENGINEERS), LIMITED, Bradford—Leaflet dealing with Type B, electrically released magnetic brakes, specially designed for machine tools.

METALECTRIC FURNACES, LIMITED, Smethwick, 40 (Staffs)—Leaflets No. M4B and M6A reviewing standard box-type furnaces manufactured by the company, and methods of continuous bright annealing, respectively.

New Patents

THE patents below are among the complete specifications accepted listed in the "Official Journal (Patents)." The numbers given are those under which the specifications have been printed and all subsequent proceedings will be taken.

Applications for copies of the full specifications (3s. 6d. each, post free) should be made to the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C.2.

Mining and Mining Appliances

821,205 SCHMIDT, P. Device for extracting jammed rockdrills.

821,050 SOC. D'ETUDES HYDRAULIQUES POUR L'INDUSTRIE MINIERE, S.E.H.I.M. Self-propelling roof supports for mine galleries.

821,086 SIEMENS & HALSKE AG. Multi-decked cage winding plants.

820,863 KLÖCKNER-HUMBOLDT-DEUTZ AG. Mine-waste crushing plant.

821,613 NAYLOR BROS., LIMITED. Conveyors.

822,233 RHEINSTAHL WANHEIM G.M.B.H. formerly EISENWERK WANHEIM G.M.B.H. Pit props.

821,795 NJOGAMI, T. Liquid-flow transport systems for raising coal.

822,029 COAL INDUSTRY (PATENTS), LIMITED. Scroll-type drilling tools.

821,671 LINSINGEN, VON M. (trading as BOCHUMER EISENHUTTE HEINTZMANN & COMPANY). Mine roof supports and the like.

822,234 RHEINSTAHL WANHEIM G.M.B.H., formerly EISENWERK WANHEIM G.M.B.H. Pit props.

822,161 BOCHUMER GESSELLSCHAFT FUR GRUBENAUSBAU UND TECHNIK. Hydraulic pit props and liquid-supply systems therefor.

821,645 DOBSON, LIMITED, W. E. & F. Hydraulic pit props.

822,162 BOCHUMER GESSELLSCHAFT FUR GRUBENAUSBAU UND TECHNIK. Hydraulic pit props.

823,128 DOWTY MINING EQUIPMENT, LIMITED. Mine roof support systems.

822,941 BARKER & SON ENGINEERS, LIMITED. W. H. Tipplers for mine cars or other rail trucks.

823,127 DOWTY MINING EQUIPMENT, LIMITED. Mine roof support systems.

823,777 DEUTSCHE ERDÖL-AG. Method of working sub-terranean deposits of anthracite, coal, lignite, or other bituminous materials or mineral oil.

823,877 MANNESMANN-TRAUZL AG. Bearing assembly for the shaft of underground hydraulic turbines for driving drill bits in deep-well drilling.

823,806 GERLACH, K., and GERLACH, H. Telescopic pit props.

824,318 COAL INDUSTRY (PATENTS), LIMITED. Rail vehicle retarders.

822,781 LOBBERT & COMPANY G.M.B.H. Supports for the walls and roofs of mine workings.

824,053 HEIDEMANN, W. Transporting apparatus, for example for underground mining.

823,253 GENERAL ELECTRIC COMPANY, LIMITED. Mine winders or the like.

823,586 HOESCH-WESTFALENHÜTTE AG. Mine roof supports.

823,459 PROGRES CHARBONNIER PROCHAR SOC. CO-OPERATIVE. Arched frames for underground levels.

825,483 CABLE BELT, LIMITED. Conveyors.

825,661 COAL INDUSTRY (PATENTS), LIMITED. Conveyor apparatus comprising one or more endless conveying elements.

825,839 GUTEHOFFNUNGSHÜTTE STERKRADE AG. Vertical closing devices for operating a sliding gate of a skip, employed in a guided skip hoist.

825,840 STAMICARBON N.V. Mine-shaft transport systems.

825,321 HOOD, A. R., and MILLER, J. W. Dust collectors for rock drills.

825,747 GUTEHOFFNUNGSHÜTTE STERKRADE AG. Control of steam winding engines.

825,719 COAL INDUSTRY (PATENTS), LIMITED. Machines for winning coal or other minerals.

826,180 CEMENTATION COMPANY, LIMITED. Means for conveying drilling equipment up and down a sinking shaft.

825,019 BARKER & SON ENGINEERS, LIMITED. W. H. Means for retarding free-running mine cars.

825,003 BAYLISS, JONES & BAYLISS, LIMITED. Removable roof- or wall-supporting device for use in coal mining and like operations.

824,800 MINING ENGINEERING COMPANY, LIMITED. Chocks for supporting roofs in mines and like workings.

825,023 KNOWLES, S. D., and WELDON, A. E. Roofing bars for use in mines.

825,194 LOBBERT & COMPANY G.M.B.H. Link linings for the walls and roofs in mine workings.

826,019 PROPS ESTABLISHMENT. Adjustable light metallic pit props.

826,142 SCHMIDT, K. (trading as SCHMIDT, K. [Firm of]). Dust extraction apparatus for underground operation.

826,168 QUALTER HALL & COMPANY (SALES), LIMITED, and LINES, C. Colliery turntables.

Metallurgy and Engineering

821,469 WILD-BARFIELD ELECTRIC FURNACES, LIMITED. Metallurgical heat-treatment furnaces.

820,924 UNTERNEHMUNGEN DER EISEN- UND STAHLINDUSTRIE AG FÜR. Apparatus for pressing the bottom roll of a roll stand against its supporting roll.

826,287 HÜTTENWERK OBERHAUSEN AG. Method for controlling the blowing operation in the conversion of steel.

820,958 WOODALL-DUCKHAM CONSTRUCTION COMPANY, LIMITED. Coke-oven and like installations.

821,593 SOC. DES ACIERIES DE POMPEY. Methods of and means for manufacturing pig-iron in a fuel-injection blast-furnace.

821,033 METALLURGICAL OXYGEN PROCESSES, LIMITED and ROBIETTE, A. G. E. Conversion of molten pig-iron to steel.

821,578 ARMCO INTERNATIONAL CORPORATION. Stainless steel.

821,288 DAVY & UNITED ENGINEERING COMPANY, LIMITED. Turn-up or turn-over gear for use with rolling mills and the like.

821,784 BOHLER & COMPANY, AG, GEB. Process for the manufacture of flat steel bars from chromium-alloyed ledeburitic tool steels, the change in dimensions when being hardened being practically the same in all directions.

821,818 SPENCE & SONS, LIMITED, P. Heat treatment of freshly-produced titanium metal.

821,879 BALDWIN - LIMA - HAMILTON CORPORATION. Method and apparatus for controlling the contour of rolls in a rolling mill.

821,690 ARMOUR RESEARCH FOUNDATION OF ILLINOIS INSTITUTE OF TECHNOLOGY. High-strength variable porosity-sintered metal fibre articles and method of making same.

Leverton Oil Clutch

HIGH SERVICE GUARANTEE

AN unconditional warranty of 4,000 service meter hours has been announced by the Leverton Group of Companies, for all Caterpillar oil clutches fitted to machines supplied by them. A warranty certificate issued with each new Caterpillar machine fitted with this clutch (Fig. 1) states, in the event of major failure prior to 4,000 service meter hours' operation, repairs will be carried out free of cost, including removal and re-installation.

Requiring the minimum of adjustment, often only once or twice per year, this advanced design component has proved to be robust and dependable under all conditions. The oil clutch is now fitted as standard equipment in all Caterpillar D9 and D8 direct-drive

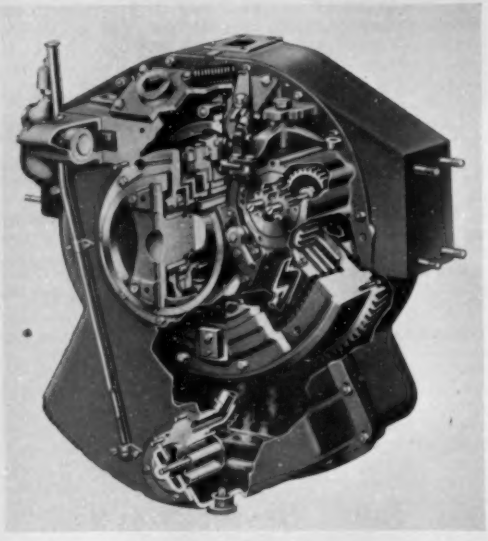

FIG. 1.—CATERPILLAR OIL CLUTCH.

tractors, D7 and D6 crawler tractors, all Caterpillar Traxcavators and motor graders; it is also an optional fitting in the new Caterpillar D4 crawler tractor.

Far exceeding any previous warranty issued for a tractor component, the Leverton 4,000-hr. performance guarantee for the Caterpillar oil clutch represents a working period of more than two years' operation.

It is emphasized that the Leverton oil clutch warranty is complementary to the usual warranty issued with each new Caterpillar earthmoving machine or equipment, covering all parts, components and assemblies incorporated in these machines.

SCOPE OF THE 1960 Fuel Efficiency and Power for Industry Exhibition has been considerably increased, offering all concerned in the provision of heat, light and power for industry an opportunity to examine the latest methods of producing efficient services at the lowest cost. The exhibition will be held at Olympia, London, from April 27 until May 6.

"Rota-tilt" Traverser at Yorkshire Colliery

IN successful operation at Manor Colliery, in the North-Eastern Division of the National Coal Board, is a combined rotating and tilting turntable for handling mine cars, designed by Mr. S. Collier, Area mechanical engineer in the Wakefield Area. The table was devised to meet conditions at Manor Colliery, where the space available for surface equipment is limited.

The table is located between the shaft and the tippler. The two parallel tracks from Nos. 1 and 2 cages lead to two tilting platforms built into the turntable. The track to the tippler is a continuation of the track from No. 1 cage. When an empty car is to be transferred from the tippler to an empty No. 1 cage it is rammed into the cage directly across the empty platform. If it is to be transferred into No. 2 cage it is first rammed on to the platform, and the table is then rotated until the empty car is opposite No. 2 cage. The platform is tilted and the car runs into the cage under gravity. Full cars which are rammed on to the turntable through the cages are also made to run into the tippler under gravity by tilting the platform when the tippler is ready to receive them.

A cycle of operations has been worked out which ensures the smooth handling at the pithead of all cars, which are of 82 cub. ft. capacity. The design can be modified to suit a circuit where the tippler is at right angles to the cages.

Operator Training in Industry

LATEST addition to the series of broadsheets on training published by the Institute of Personnel Management, "Operator Training in Industry," by W. Douglas Seymour, is now available, price 7s. 6d. It is concerned with the training of unskilled and semi-skilled operators in manufacturing industries, *i.e.*, those in occupations for which time-served apprenticeships are not required. The type of work is grouped into the following categories: handwork, handwork with tools, single purpose machine work, multi-purpose machine work, group machine work, and non-repetitive work.

The booklet outlines some recent developments in techniques of training, based on wartime experience in the services and munition factories and, more recently, on investigations into industrial skills and their acquisition in a number of universities and research institutions. These techniques are now being used in a number of industries in both the United Kingdom and oversea.

Underlying these techniques is the recognition that operator skills in industry are very varied and highly developed, and that the training of new workers to acquire such skills must be based on an adequate analysis and understanding of the skills.

Previous publications in this series include "Industrial Training—An Introduction," by A. Tegla Davies," and "Management Development," by F. I. de la P. Garforth.

DIVISIONAL stores for the Durham Division of the National Coal Board are to be constructed by Holland & Hannen & Cubitts (Scotland), Limited, at Lambton.

Orders Placed

Big RTB Order for Aberdeen Engineers

ORDER received by John M. Henderson & Company, Limited, Aberdeen, for coke-oven machinery and mechanical handling plant for the Spencer Works of Richard Thomas & Baldwins, Limited, is described as the largest single order yet placed with the Scottish firm. The contract is worth £500,000.

Mr. Richard E. Spain, general manager of John M. Henderson & Company, said that the contract had been gained against strong competition from other British firms. It was hoped to start making deliveries by the end of the year.

A RUSSIAN CONTRACT worth about £47,000 has been placed with Dowding & Doll, Limited, London, W.14, for 20 Dowding universal hobbing machines with all equipment, including tangential feed.

TELCON CABLE machinery for the new French cableship Marcel Bayard is to be supplied by Submarine Cables, Limited, which is jointly owned by Siemens Edison Swan, Limited, and the Telegraph Construction & Maintenance Company, Limited.

CONTRACTS WORTH £16,000 have been awarded to William Boby & Company, Limited, water treatment engineers, of Rickmansworth (Herts), for dealkalisation/base exchange plants by George Wimpey & Company, Limited, for the Union Carbide, Limited, works at Hythe (Hants).

CHINA HAS PLACED an order worth £8,000 for six gas-liquid chromatographic analysis apparatus manufactured by Griffin & George, Limited, Alperton (Middx). This is the second large Chinese order for the firm in 12 months and raises to nine the number of these instruments in use in China.

EQUIPMENT FOR the Moscow printing plant of Pravda has been ordered from Witton-James, Limited, London, N.W.9, a subsidiary of the General Electric Company, Limited. The order, worth about £30,000, is for eight electro-tab autopasters and eight sets of pneumatically-controlled tensioning equipment.

CONTRACTS VALUED AT nearly £2,000,000 have been placed with Associated Electrical Industries, Limited, for the supply of practically the whole of the electrical equipment for Colvilles' new cold-reduction plant at Gartcosh, near Ravenscraig. AEI is also supplying a large quantity of electrical equipment for Colvilles' new hot mill at Ravenscraig.

ROMEO PORTA, an Italian cable-manufacturing company with a factory near Milan, has ordered a thermatic extruder from Fawcett, Preston & Company, Limited, Bromborough (Ches), a subsidiary of the Metal Industries group. Purpose of the extruder is to cover cable with plastic. A Fawcett, Preston official said that although the value was only £4,000, the order was particularly encouraging because the Italians themselves produced an extruder and the market was thus highly competitive.

TWO NEW TUGS—the most powerful in the Bristol Channel—have been built to handle the extra traffic at Newport Docks when the new Spencer steelworks, at Llanwern, starts production. The first, the St. Woolos, was handed over to the British Transport Commission on Tuesday. The second, the Llanwern, is expected in about six weeks. Both have been built by P. K. Harris & Sons, Limited, of Appledore, in association with Seawork, Limited, of London.

The Scrap Markets

Vindicated by Events

QUESTIONED at the time of its imposition, the stoppage of all exports of ferrous scrap has been fully vindicated by subsequent events. It is no longer questioned that this will be a year of excessive strain upon suppliers of home scrap. There is already an abundance of outlets for the disposal of the better types of heavy steel scrap.

Cleveland—Steelfoundries are taking up all available supplies of short heavy steel scrap. More slowly the market for cast-iron scrap is improving and blast-furnacemen are seeking increased supplies of borings, turnings, and destructor scrap.

The better qualities of heavy steel scrap are moving away as fast as the merchants can supply.

South Wales—Steelworks and ironfoundries are making heavy demands on merchants for the heavy and better grade metal. There is some movement in light grade material, due to delay in getting full quantities of the better types. Merchants are constantly seeking further sources of supply of best-quality metal.

Lancashire—Busier conditions continue to be reported in most sections of the Lancashire iron and steel markets, a feature of which is the steady demand from steel producers for steel-melting scrap. Increased buying interest is also being shown by the foundries in machinery metal and other descriptions of cast scrap and a good many users are showing a readier disposition to add to their reserves.

Fair quantities of textile machinery scrap, the direct result of the Government's cotton trade reorganization scheme, continue to come on to the market.

Scotland—Pressure for additional supplies of scrap continues to come from the steelmakers. Output of steel turnings remains very steady and good deliveries are being effected to the consuming works, while the production of cast-iron borings is about up to the average and the blast furnaces are open to accept material as it becomes available.

South African Project for Rubery, Owen

AS a result of an agreement between Rubery, Owen & Company, Limited, structural and manufacturing engineers, of Darlaston (Staffs), and the Vanderbijl Engineering Corporation, Limited, of Vanderbijlpark, South Africa, the manufacture of motor vehicle components is to be greatly expanded in South Africa. In addition to considerable financial investment in the new project, Rubery, Owen is contributing design work, tooling and "know-how" from its own resources.

Rubery, Owen is the parent company of a group of 46 companies mostly concerned with engineering and for some time the organization has been considering establishing a motor vehicle component manufacturing plant in South Africa.

Vecor was founded in 1947 by the South African Iron & Steel Industrial Corporation, Limited, in association with other large industrial and financial organizations. Its subsidiary, Metal Pressings, Limited, has already reached agreement with certain motor assemblers in the Union for the supply of wheels and other components.

Company News

Dropforgings Merger

BROCKHOUSE OFFER FOR COVENTRY ASSOCIATE

AGREEMENT has been reached between the boards of J. Brockhouse & Company, Limited, dropforgers, makers of laminated axles, road springs, etc., of West Bromwich, and Albion Drop Forgings Company, Limited, Coventry, with a view to the complete integration of Albion into the Brockhouse group. The latter already owns 145,290 5s. ordinary shares in Albion and will make an offer to acquire the remaining 574,710 shares on the basis of one Brockhouse ordinary £1 share for every two Albion ordinary.

The offer will be conditional upon acceptance by the holders of 90 per cent., or such smaller percentage as may be agreed, of the ordinary shares of Albion to which the offer relates. Subject to unforeseen circumstances it is the present intention of Brockhouse to declare an interim dividend as usual next May and the shares of the group to be issued under the offer will participate in it.

The directors of Albion Drop Forgings recommend the offer to their shareholders and intend to accept in respect of their own shareholdings. A formal offer will be sent to Albion shareholders by Philip Hill Higginson Erlangers, Limited, as soon as possible.

PEASE & PARTNERS, LIMITED, foundrymen, of Darlington (in voluntary liquidation)—A first capital return of 4d. per 1s. share, payable about February 13, is announced.

DUCTILE STEELS, LIMITED, Willenhall (Staffs)—An extra-ordinary meeting is called for February 17 to create capital and to effect a one-for-one scrip issue to holders of February 2.

SCAFFOLDING (GREAT BRITAIN), LIMITED, Mitcham (Surrey)—An agreement has been entered into to purchase for about £25,000 all the capital of G. C. Cook, Limited, electrical and mechanical engineers, of London, S.W.8.

BRECKNELL, DOLMAN & ROGERS, LIMITED, manufacturers of wrapping and packing machinery, etc., of Bristol—The directors propose a one-for-one scrip issue on the ordinary stock. The authorized capital is to be increased to £500,000.

BRITISH ELECTRIC RESISTANCE COMPANY, LIMITED—The company is to make an issue in 2s. ordinary shares on the basis of one at 5s. for every five held today (Friday). The board expects to maintain at least the present rate of dividend on the larger capital.

GENERAL ELECTRIC COMPANY, LIMITED—Provisional results for the first eight months' trading and estimated figures for the rest of the current year ending March 31, 1960, indicate an increase in both turnover and profit earnings. The interim dividend is maintained at 3 per cent.

M. MOLE & SON, LIMITED, makers of metal pressings, stampings, diecastings, etc., of Birmingham—Net profits amounted to £43,886 (£38,574), after tax of £29,414 (£35,767), and the dividend is 11¼ per cent. on doubled capital, against 20 per cent. and a bonus of 2½ per cent. on the old capital.

PELAPONE ENGINES, LIMITED, Derby, a member of the Steel & Company, Limited, group, has changed its name to Pelapone, Limited, as its former name tended to misrepresent the company's current field of activities which is increasingly concerned with electrical control gear and equipment.

S. RUSSELL & SONS, LIMITED, ironfounders, of Leicester—A one-for-one scrip issue to holders of February 1 is announced. Current year profits are expected to be up on last year. Prospective final dividend for the year to March 31, 1960, is "not less than 7½ per cent." on the increased capital.

WESTINGHOUSE BRAKE & SIGNAL COMPANY, LIMITED—Confidence that the group will achieve good results for the current year is expressed by the chairman, Mr. A. R. S. Nutting. He warns, however, that they may not be quite so good as the record profit figures returned for the 53 weeks ended October 3, 1959.

WRIGHT'S ROPES, LIMITED—As a result of the realization of the holding in Eagle Star Insurance Company, Limited (representing shares formerly held in Midland Employers' Mutual Assurance, Limited), a capital profit of £105,006 has been made. It is proposed that £103,125 of this be distributed, without deduction of tax, at the rate of 2s. 9d. per £1 ordinary share.

JOHN BOLDING & SONS, LIMITED, engineers and sanitary appliance manufacturers, of London, W.1—The final dividend is being increased by 3 per cent. to 12½ per cent. to make 15 per cent. for 1959, against 12 per cent. Group trading profits are lower, after depreciation, at £97,368 (£109,247), but due to a reduced tax charge, the net balance is up from £49,397 to £53,968.

HADFIELDS, LIMITED—Group profits, including £112,500 in respect of the previous year, fell to £486,536 (£609,005) in the year ended October 3, 1950. Tax was substantially lower at £301,453 (£425,357) and there is an available net balance of £302,575 (£200,783). The dividend is held at 6 per cent. with a final of 4 per cent., following a 3 per cent. cut in the rate last year.

COVENTRY GAUGE & TOOL COMPANY, LIMITED—Experience of the first four months of the current year shows a much improved order position with a generally brighter industrial outlook for capital goods, states the chairman, Sir Stanley J. Harley. However, it may well be some time before the benefits of all the steps taken in the year become fully effective and apparent in the results.

HARPER ENGINEERING & ELECTRONICS, LIMITED—Contracts have been exchanged for the purchase of all the £50,000 ordinary capital of B. O. Morris (Holdings), Limited, makers of flexible shaft grinding machinery,

etc., of Coventry, in exchange for 1,150,000 Harper 1s. shares, subject to permission to deal. It is understood that the deal is worth over £680,000. Mr. E. M. Morris, chairman of B. O. Morris, will join the Harper board.

ARTHUR LEE & SONS, LIMITED, manufacturers of wire and bright-drawn strip, etc., of Sheffield—The directors propose the capitalization of £1,500,000 from the share premium account in a scrip issue of 12,000,000 2s. 6d. ordinary shares on a one-for-one basis. The authorized capital is to be increased from £1,650,000 to £4,000,000 by the creation of 18,800,000 shares of 2s. 6d. It is also proposed to raise the maximum number of directors to 12.

CASTINGS, LIMITED—The company is applying to the committee of the Stock Exchange, Birmingham, for permission to deal in, and for quotation for, 2,000,000 ordinary 2s. shares, the whole of the issued share capital of the company. The placing price is 3s. 1½d. The directors expect profits for the current year ending March 31, to be in excess of £75,000, subject only to tax. A final dividend of 5 per cent. is foreshadowed, making 12½ per cent. for the year.

B. FINCH & COMPANY, LIMITED—A one-for-one scrip issue to holders of February 8 is announced. The new shares will not participate in the final dividend for 1959. The audit of the 1959 accounts is not yet completed, but the board "thinks it reasonable to assume" that the profit for the year will be in excess of the previous year, and, if so, will be fully justified in recommending a substantial increase in the rate of the final dividend. An extra-ordinary meeting will be held on February 16.

FRANCIS SHAW & COMPANY, LIMITED, makers of machinery for the rubber and plastics industries, of Manchester—A formal offer has been made for all the issued ordinary and preference share capital of Jos. Robinson & Company (Holdings), Limited, which is largely engaged in similar activities. The Robinson directors have recommended the offer to holders. Francis Shaw & Company intends that the Robinson group should continue to operate as before and that existing staff should be retained.

GENERAL CABLE MANUFACTURING COMPANY, LIMITED—The chairman, Mr. C. W. R. Pantlin, reported a year in which net profits, before tax, were the lowest since the company became public in 1935. He could offer shareholders little encouragement for the immediate future and said it was essential that they should clearly understand not only the nature and origin of the difficulties facing the company but also the possibility that they would persist—on what was hoped would be a diminishing scale—for a period of 18 months to two years.

JOHN HARPER & COMPANY, LIMITED, general iron-founders and oil and gas appliance manufacturers, of Willenhall (Staffs)—Application is being made for a quotation on the London Stock Exchange. The shares have been quoted in Birmingham for many years. Issued capital consists of 150,000 4½ per cent. £1 redeemable preference shares and £1,012,500 in 5s. ordinary. Dividend on the ordinary has been a steady 10 per cent. interim plus a 20 per cent. final followed last time by a 200 per cent. scrip issue. The interim for the current year to March 31, 1960, was 4 per cent.

AVERY'S, LIMITED, weighing machine manufacturers, of Birmingham—A tax-free distribution of 11d. per £1 unit absorbing £187,919 of capital reserve is to be made. The directors state that this distribution will not be taken into account when determining the final dividend for the year ending March 31, 1960. It is pointed out that the company owned shares in Midland Employers' Mutual Assurance and that a share exchange offer from Eagle Star Insurance for MEMA shares was accepted last July. The Eagle Star shares have now been sold, realizing about £190,000, which is surplus to requirements.

STEEL & COMPANY, LIMITED, holding company for engineering concerns, of Sunderland (Co. Durham)—The future now looks bright and unless some economic or political crisis intervenes there is every prospect of a continuing flow of orders and of steadily rising production, states the chairman, Mr. J. Steel, in a circular to shareholders. In the latter half of the next financial year production and sales are expected to be considerably higher than in the same period of 1959, but this will still be below maximum. With a return to full production previous record profit should be surpassed within the next three years.

WEARDALE LEAD COMPANY, LIMITED—Since September home orders of metallurgical grade fluorspar have considerably improved and the chairman, Col. H. Haswell Peile, is reasonably confident that the company will revert to its former level of metallurgical grade sales this year. The entry of other producers has resulted in refined fluorspar general price reductions. The board is actively engaged in this problem. Substantial mineral reserves exist and particularly since September the metallurgical market has improved. Net profit for the year ended September 30 last was £4,513, compared with a loss of £2,540 for the previous year, and the dividend was 7½ per cent. (nil).

NEEPSEND STEEL & TOOL CORPORATION, LIMITED—The company is maintaining its interim at 12½ per cent. on capital increased by a one-for-four scrip issue. This represents an effective rise of 2½ per cent. Previous year's final of 37½ per cent. is equivalent to 30 per cent. on the present capital. The president, Sir Stuart C. Goodwin, says it is too early to assess trading results for the year ending March 31, 1960. He refers to a serious recession in the early part of the period, but adds that conditions have changed considerably in recent months and that the directors are hopeful that results will be comparable with those of previous years. An extra-ordinary meeting is to be held on March 31 to increase the permitted number of directors from seven to nine.

Bid of £600,000 for Redler Industries

CASH offer of £600,000 for the 1,000,000 ordinary shares of Redler Industries, Limited, Stroud (Glos), makers of conveyors, elevators, etc., has been made by Ley's Foundries & Engineering Company, Limited, Derby. This means that the Derby company is offering 12s. for each Redler 4s. share.

Made subject to the usual conditions, the offer is accompanied with a letter from the Redler chairman recommending acceptance. In the event of the offer becoming unconditional, Redler Industries and its operating subsidiaries will retain their identities and names and, so far as possible, the present executive directors and senior staff will continue to run the companies. The interests of the employees generally will be safeguarded, it is stated.

An offer has since been made by Cozens & Sutcliffe (Holdings), Limited, structural engineers and contractors, of Enfield (Middx), for the ordinary shares of Redler Industries. Shareholders are advised not to dispose of their shares until they have received details of the offer.

THE COAL TRADE

DEMAND for the best descriptions of domestic fuel remains at a high level and it is quite usual for merchants to keep householders waiting several weeks for supplies. The position has eased somewhat with the passing of the really bad weather, but order-books are sufficiently well filled to ensure that merchants' transport will be kept fully engaged for some time. There is still a good call for supplies of industrial coal and coke, supplies of which are coming forward regularly again following the period of delay caused by the severe weather.

SOUTH-WEST LANCASHIRE

The much busier atmosphere in the domestic trade continues, and merchants are receiving a constant flow of orders for all qualities. Supplies have been below normal, mainly because of a shortage of railway wagons, but this has not affected the general distribution as good ground stocks are maintained. Anthracite nuts are in strong demand, but deliveries are delayed. "Phurnacite," however, is readily available. "Coalite" and "Rexco" show a steady improvement in demand and deliveries are satisfactory. It is hoped that this improvement in the domestic trade will continue for the rest of the winter, as the additional tonnage is needed by distributors to overcome losses during summer and autumn.

The improved demand for gas coke and gas coke nuts, for domestic and central heating, is well maintained. Ample supplies of gas coke exist at most of the large gasworks in this area, and there are no serious delays in delivery. The only qualities which are slightly delayed are the very small sized fuels used mainly for automatic stokers. Hard coke and sized hard coke nuts continue to be in good request mainly for engineering and shiprepairing, and there are good supplies ready for prompt despatch. In the general industrial market, allocations are well maintained and deliveries are prompt by road and rail.

Steady working conditions continue at Liverpool, Birkenhead, and Manchester docks. Bunker coals for foreign and coastal steamers are in good supply, but the demand is reduced. No bunkering delays are reported.

House coal prices (per ton):—Group 1, 202s. 8d.; Group 2, 183s. 3d.; Group 3, 166s. 5d.; Group 4, 154s. 8d.; Group 5, 141s. 7d.; Group 6, 131s. 5d.; Group 7, 117s.

This was Charles Bollans' Life

BASED on the BBC's television programme "This is Your Life," miners at Welbeck Colliery, Cuckney (Notts), acknowledged Mr. Charles Bollans' work for the mining industry at a presentation ceremony last week. Mr. Bollans, who is 65, has retired from the post of assistant to the colliery manager after 34 years at the pit.

On the stage of the village hall 27 of his former associates—from colliery managers to the village policeman—appeared to recall highlights in his mining career which began 50 years ago when he started as a haulage hand at Annesley Colliery. One of them was Mr. James Marshall, whose rescue 10 years ago earned Mr. Bollans and an overman, Mr. Fred Riley, the King's Commendation for bravery.

In addition to a bound volume recording his life at the pit, and the NCB long-service certificate, Mr. O. T. Storrs, representing No. 3 Area of the East Midlands Divisional Coal Board, presented Mr. Bollans with an oak cabinet from the colliery employees.

Welsh Coal Shipments Highest for a Year

SOUTH Wales ports recorded their highest coal shipments for more than a year last week, when the total of 80,611 tons exceeded the previous week's figure by 26,785 tons; it was 16,923 tons higher than in the corresponding week last year. In addition, it was the best total since the week ended October 12, 1958, when 83,244 tons were shipped.

Barry's figure of 24,884 tons was the best since July 20, 1958, when the shipment was 26,562 tons, and 15,815 tons shipped from Cardiff was the highest figure since December 14, 1958, when 19,966 tons were shipped. Swansea's total of 26,237 tons was the highest since December 20, 1959, when there was a shipment of 27,684 tons. The figures include foreign and coastwise cargoes.

Figures for the various ports for last week (with figures for the corresponding week last year in brackets) were:—Newport, 8,319 (8,634) tons; Cardiff, 15,815 (5,489) tons; Penarth 5,356 (5,387) tons; Barry, 24,884 (21,810) tons; Port Talbot, nil (1,369) tons; Swansea, 26,237 (20,999) tons.

Harland Engineering Reorganization

REALIZING that the small unit specifically devoted to applied engineering but divorced from the manufacture of its plant requirements is at a disadvantage compared with the larger unit backed by its works, the Harland Engineering Company, Limited, makers of centrifugal pumps, water turbines, and electrical machinery, of Alloa, Scotland, has decided to close its ranks by changing the operation of its separate wholly-owned subsidiary, Harland Drives, Limited, London, W.1, to a division of the parent company.

The board's decision was influenced by the desire to achieve greater efficiency and competitive ability and to give an even higher standard of service. As a first step towards the reorganization the management of Harland Drives was vested in the board of Harland Engineering as from Monday.

MUREX, LIMITED—Mr. F. W. Tomlinson, managing director of Pyrotenax, Limited, Mr. J. M. Willey, a director and general manager of Murex Welding Processes, Limited, and Mr. P. S. Bryant, have been appointed to the board. Mr. Tomlinson has also been appointed to the board of Murex Welding Processes.

Board Changes

Head Wrightson's New Chairman

FOLLOWING the retirement of Mr. Richard Miles, Sir John Wrightson has been appointed chairman and managing director of HEAD WRIGHTSON & COMPANY, LIMITED, engineers, foundrymen, etc., of Thornaby-on-Tees (Yorks).

SIR JOHN WRIGHTSON

Mr. Miles, who retired at the end of the company's financial year, January 31, 1960, had been chairman of the company for 10 years and managing director for 25 years. He remains on the board of the parent company. Sir John, who is 48, is a grandson of one of the founders of the firm and was appointed its vice-chairman and managing director 10 years ago. He is chairman of several of the Head Wrightson subsidiaries and a director of the remainder and also of other companies, including the Nuclear Power Plant Company, Limited, and Smith's Dock Company, Limited. He is a High Sheriff of County Durham and chairman of the finance committee of the Tees Conservancy Commission.

DAVIS & TIMMINS, LIMITED—Mr. Ernest B. M. Grubb has been appointed a director.

HOPKINSONS, LIMITED—Mr. Graham M. Wells, sales director, has been appointed assistant managing director.

BTR INDUSTRIES, LIMITED—Sir Walter Worboys has been elected to the board and appointed a deputy chairman.

WILLIAM BAIN & COMPANY, LIMITED—Mr. Colin C. Smith and Mr. J. W. Rankin have been appointed to the board.

MCKECHNIE BROS., LIMITED—Mr. Ernest Hartles, commercial director of the company, has been appointed assistant managing director.

CAMMELL LAIRD & COMPANY, LIMITED—Mr. J. C. Mather, who recently resigned from the chairmanship, has been appointed deputy chairman of the company.

HARRISON (BIRMINGHAM), LIMITED—Mr. William H. Demel, for 15 years managing director, has intimated his wish to retire at the end of June owing to his age and health.

BRITISH ROLLMAKERS CORPORATION, LIMITED—Mr. Denis F. Dodd and Mr. Richard H. Higgs have been appointed directors following the acquisition of the whole of the issued share capital of Richard Lloyd, Limited.

TELEGRAPH CONSTRUCTION & MAINTENANCE COMPANY, LIMITED—Mr. D. T. Hollingsworth has joined the board and has been appointed deputy chairman. The company is a subsidiary of British Insulated Callender's Cables, Limited, of which he is a director.

CATERPILLAR TRACTOR COMPANY—Mr. James A. Folger has been elected to the board of the company. In our January 15 issue, we inadvertently stated that he had joined the board of the Caterpillar Tractor Company, Limited, which is the UK subsidiary of the Caterpillar Tractor Company, of Peoria, Illinois, USA.

SIR WILLIAM ARROL & COMPANY, LIMITED—Mr. W. I. French has been elected deputy chairman, and Mr. Alfred Davis, formerly special director at the crane works, has been appointed a director of the company in full charge of the works. Mr. W. Reside, who will remain a special director at the crane works, has been appointed chief engineer there.

GLACIER METAL COMPANY, LIMITED—Mr. D. J. Clarkson and Mr. R. J. Welsh have resigned as directors of the company. Mr. Welsh has also resigned his directorship of the Genuine Thin Wall Bearing Company, Limited, a wholly owned subsidiary of the Glacier Metal Company. Mr. F. B. McPherson has been appointed a director in his stead.

BRYMBO STEEL WORKS, LIMITED—Mr. A. F. Gadsby, one of the original directors of the present company when it was incorporated in 1948 at the time when the company became a member of the Guest, Keen & Nettlefolds, Limited, group of companies, has resigned owing to pressure of other work. Mr. P. H. Meadows, the company's secretary since 1953, has been appointed to the board.

SIMMONDS AEROCESSORIES, LIMITED—Mr. A. Beard, formerly chief production engineer, Mr. W. J. Burnell, chief mechanical engineer, Mr. S. H. Goss, general sales manager, Mr. A. P. H. Pehrson, export manager, and Mr. C. J. Williams, works manager, have been appointed to the board. All were previously executive directors. Mr. Goss and Mr. Williams have also been appointed assistant managing directors.

FLUIDRIVE ENGINEERING COMPANY, LIMITED—Mr. John F. Perry, who was formerly managing director of Metropolitan-Vickers Electrical Export Company, Limited, and a director of AEI (Overseas), Limited, has been appointed chairman. He succeeds Mr. Harold Sinclair, who has retired from the board to concern himself more fully with the work of associated companies in the field of patents and licensing, chiefly in Europe and North America.

BIRMID INDUSTRIES, LIMITED—Mr. W. C. Jordan, deputy managing director of Birmabright, Limited, and Birmetals, Limited, subsidiary companies, has been appointed joint managing director. Mr. R. T. Raven, works director, has been appointed director and general manager and Mr. C. J. Smith, works metallurgist, becomes technical director. Mr. T. Player, manager of the iron division of Sterling Metals, Limited, another subsidiary, is appointed a director.

WHITTAKER, HALL & COMPANY (1929), LIMITED—Mr. R. B. Walker has been appointed managing director in succession to Mr. J. M. Brohee, who has retired. Mr. Walker, son of a former director, joined the firm in 1936 and has himself been a director and assistant manager for several years. Mr. Brohee has been associated with the firm since 1919. He became a director in 1933, managing director in 1940, and chairman in 1942. He will remain chairman of the company.

JESSHOPE (HOLDINGS), LIMITED—Mr. L. L. Rose has been elected a director and chairman of the company and a director of its subsidiaries in the place of Mr. A. P. Jesshope, who has resigned owing to ill-health. Mr. Jesshope has been appointed consultant to Jesshope, Limited, the principal subsidiary. Mr. A. Wood has resigned his posts as a director of Jesshope (Holdings) and its subsidiary, but remains secretary of them. Mr. S. T. Bambury and Mr. N. L. Hodgkinson have resigned their directorships of the holding company, but remain directors of Jesshope, Limited.

Appointments

Massey-Ferguson Reorganization

UNDER the reorganization of the engineering division in the UK of Massey-Ferguson, Limited, Dr. B. F. WILLETTS has been made chief engineer, UK, under the direction of Mr. EWEN M'EWEN, director of engineering, Europe. Dr. Willetts carried out research for the Ministry of Supply and subsequently served for a number of years with Vickers-Armstrongs, Limited, before joining Massey-Ferguson in 1958. His two assistant chief engineers are Mr. L. E. SUMMERFIELD (implements) and Mr. H. R. JENNER (combine harvesters). Mr. Summerfield was for 13 years with Bendix, Limited (later Girling, Limited), and Mr. Jenner joined Massey-Harris, Limited, Toronto, in 1923.

Mr. M'Ewen, who is responsible for all functions of engineering design, development, and research, not only in the UK, but also in France, Germany, and India, was a leading authority on fighting vehicle design during the war. In 1947 he was appointed Professor of Agricultural Engineering, King's College, Durham. From 1955 to 1958 (when he joined Massey-Ferguson), he was director, UK Armament Research Development Establishment.

Another recent appointment within the UK engineering division is that of Mr. CHARLES HUNT, who has become chief test engineer. Before joining the company he held various senior appointments with Vickers-Armstrongs.

Mr. S. H. IRELAND has been appointed assistant managing director of the Consolidated Pneumatic Tool Company, Limited, London, S.W.6.

Mr. R. URWIN, manager of Fenhall Drift, Lanchester (Co. Durham), has been appointed manager of Eden Colliery, Leadgate. He succeeds Mr. J. B. NICHOLSON, who has moved to Wardley Colliery, Pelaw.

Mr. R. CUTLER, works accountant at the Bedford factory of Brookhirst Igranic, Limited, a member of the Metal Industries, Limited, group, has been additionally appointed chief cost and works accountant of the company.

Sintered Products, Limited, Sutton-in-Ashfield (Notts), announces the appointment of Mr. JOSEPH GREATOREX as chief inspector. Mr. Greatorex, an associate member of the Institute of Engineering Inspection and a licentiate of the Institute of Metallurgists, has been with the company since 1953, latterly as head of the inspection department.

Mr. E. V. TIDBURY has been appointed Midlands sales engineer of Birtley Engineering, Limited, Birtley (Co. Durham), a company in the BSA group. He will work from the company's office at West Bars, Chesterfield. This duty in northern England and Scotland is now covered by Mr. T. A. Weatherspoon, who is based on Birtley, and the Home Counties are the responsibility of Mr. S. Dickinson, operating from 54, St. James's Street, London, S.W.1.

The West Midlands Divisional Coal Board has appointed Mr. W. H. CROSSLAND as manager of Baggeridge Colliery. He has been manager of Cannock Chase No. 3 and No. 8 collieries for the past two-and-a-half years, before which he had mining experience in both the North-Eastern and East Midlands Divisions. The new manager of Cannock Chase No. 8 Colliery is Mr. T. E. SMALES. For the past year he has been manager of Hawkins Colliery in the Cannock Chase Area. Previously, he held management appointments in the North-Eastern Division and in the North Staffs Area.

Mr. T. C. JOHNSTON, formerly general manager of Metropolitan Electric Cable & Construction Company, Limited, has been appointed Eastern regional manager of British Insulated Callender's Cables, Limited. Mr. Johnston joined Callender's Cables & Construction Company, Limited, in 1937 and two years later transferred to Metropolitan Electric Cable as sales manager. Except for intervening war service, he held this position until 1958, when he was appointed general manager. He was a director of the company from 1956 until the beginning of this year when its activities were merged with those of BICC.

Mr. CHRISTOPHER STEPHENSON has been appointed a director of Sir James Laing & Sons, Limited, and also of Joseph L. Thompson & Sons, Limited, both of Sunderland. Until December 31, when he retired, Mr. Stephenson was general manager of Hawthorn, Leslie (Shipbuilders), Limited, Hebburn-on-Tyne. He begins his new duties on Monday and is to take an active part in shipyard production. Also appointed to the board of Sir James Laing & Sons, Limited, are Mr. HENRY JOHN ADAMS, naval architect at the Deptford yard for the past four years, and Mr. GUY HARFORTH, chief estimator, who has been with the company for 24 years.

A foundry machinery adviser has been appointed to the Bedewell division, Hebburn-on-Tyne, of Baker Perkins, Limited, Peterborough. He is Mr. F. ARNOLD WILSON, who has joined the company's foundry machinery department in a part-time capacity. Mr. Wilson, who is 65, retired last autumn after 40 years' service with William Jacks & Company, Limited, London, E.C.2, having managed that company's home pig-iron department. He has been closely associated with the Institute of British Foundrymen over the years and has also served on many committees in the foundry trade, including the Pig Iron Merchants' Association, the Foundry Coke Merchants' Association, and the National Federation of Iron and Steel Merchants.

Babcock & Wilcox, Limited, announces the appointment of Mr. A. S. PEACOCK as purchasing controller. He will have responsibility for all matters of company buying policy and will operate from the London headquarters of the company at Babcock House, 209, Euston Road, London, N.W.1. His predecessor, Mr. J. S. GREENHALGH, has been appointed manager of the constructional equipment division, with responsibility for control and co-ordination in the manufacture and marketing of new products for the building and contracting industries—Babcock-Richier vibratory road rollers and concrete mixers, Babcock-Weitz tower cranes, and Babcock-Marion earthmoving equipment, all of which are to be produced at the company's Dalmuir works. The headquarters of the new constructional equipment division will be at Lynton House, 7-12, Tavistock Square, London, W.C.1.

Mr. W. E. A. WILLIAMS has been appointed manager for "Sifbronze" welding products manufactured by the Suffolk Iron Foundry (1920), Limited, Stowmarket. Mr. Williams, formerly London and south-east area representative, joined the company in 1958 from F. J. Edwards, Limited, London, N.W.1. He will operate from the head office at Stowmarket. His former work will now be undertaken by Mr. G. A. EDMUNDS, who will work from 89, Ashbourne Road, Mitcham, Surrey (telephone: MITcham 8046). Mr. Edmunds was senior welder for the Robert W. Hunt Company, inspecting engineers, of London, W.C.2. Suffolk Iron Foundry has also appointed Mr. S. E. WITHERINGTON as its

Birmingham area "Sifbronze" representative. He replaces Mr. E. CHRISTIE, who returns to head office because of ill-health. Mr. Witherington will operate from 21, Stud Lane, Birmingham, 33 (telephone: Stechford 5804).

Works manager of the Ebbw Vale works of Richard Thomas & Baldwins, Limited, since March, 1958, Mr. C. G. DAVIES, has been appointed general manager of the company's Redbourn works at Scunthorpe (Lincs). He will take up his new post shortly, succeeding Mr. W. O. Campbell Adamson, recently appointed general manager of the new Spencer works being built at Llanwern, near Newport (Mon). In 1924, Mr. Davies joined the Grovesend Steel & Tinplate Company as a steelworks metallurgist at the Bryngwyn steel-sheet works at Gorseinon. Two years later he became manager of the finishing departments there. In 1929, he was awarded the Robert Blair Fellowship, enabling him to visit the United States to study the production of steel and galvanized sheets. On his return, he was appointed manager of the Bryngwyn works, leaving in 1938 to become assistant manager of the steel-sheet departments at the new Ebbw Vale works. He was appointed manager of these departments in 1940, and became assistant works superintendent (iron and steel) in 1955. Mr. Davies is a member of the Iron and Steel Employers' Standing Committee and the steel-making panel of the British Iron and Steel Research Association. He was a member of the OEEC galvanizing productivity team which visited the US in 1951.

OPTIMISM OF DORMAN LONG CHAIRMAN

GREATER and less qualified optimism than that expressed in his annual review, was voiced by Sir Ellis Hunter, chairman of Dorman Long & Company, Limited, at the annual meeting on Wednesday. The improved demand for steel had continued, orders on hand were substantial and the outlook encouraging. The record output of rolled steel which the company achieved in the first week of November had since been surpassed.

Sir Ellis felt that they might expect, from the recent Board of Trade estimate of higher capital expenditure this year, to find reflection in more work at home for the structural engineering members of the group, and oversea the requirements of the underdeveloped countries would almost certainly expand. Progress in some of them might be quite rapid and the structural steel industry could play a valuable part in this development.

Ford Factory for Merseyside

MAJOR expansion of car production by the Ford Motor Company, Limited, is to be located on Merseyside. The chairman of the company, Sir Patrick Hennessy, announced on Wednesday that negotiations for the purchase of a site at Halewood, south-east of Liverpool, were in an advanced stage.

The company will be returning to Lancashire as, before the Dagenham plant was built, the English Ford works were in Manchester. At Halewood it is proposed to erect in the first instance factory buildings covering more than 2,000,000 sq. ft. at an estimated cost of over £25,000,000 to accommodate an integrated car body plant, including stamping, body assembly, paint, trim, and final assembly operations. About 8,000 will be employed in the production of 200,000 cars a year.

Obituary

MR. D. GLYN LEWIS

THE death has taken place of Mr. D. Glyn Lewis, Area staff manager, Rhymney Valley Area of the South-Western Divisional Coal Board. Mr. Lewis, who was 55, was formerly Area administrative officer for the board. Before nationalization he was chief cashier of the collieries in the Powell Duffryn Associated Collieries, Limited, group.

He started his association with the company as a boy at the Powell Duffryn offices in the Aberdare Valley and for several years was secretary to Mr. Douglas A. Hann, a director of the company. Mr. Lewis was a vice-president of the Mining Society of the Ystrad Mynach College of Further Education and had served on the management committee of the Bargoed YMCA.

Mr. JOHN WILLIAM HEAL, landsale manager for many years at Backworth Colliery (Northumberland), has died at his home at Shiremoor.

The death occurred on January 25 of Mr. E. R. CRAMMOND, deputy chairman of Hopkins, Limited, valve manufacturers, of Huddersfield. Mr. Crammond had been associated with the company since 1935, and became deputy chairman in 1937.

The death took place on Monday of last week of Mr. FREDERICK TYLDESLEY, formerly office manager of Baxendale & Company, Limited, lead manufacturers, plumbers' and builders' merchants and exporters, of Manchester. Mr. Tyldesley had been with the company for 50 years.

The death has occurred of Mr. JAMES MITCHELL SIMPSON DALGLEISH, works manager of Martin, Black & Company (Wire Ropes), Limited, Coatbridge, from its inception in 1933 until about 10 years ago. Mr. Dalgleish later acted in an advisory capacity for the firm until shortly before his death. He was 60.

Mr. HAROLD GWYNNE ALLEN, who died on January 22, was for over 50 years a director of W. H. Allen, Sons & Company, Limited, mechanical, hydraulic, and electrical engineers, of Bedford. Up to his retirement from the board on June 30, 1959, he had been deputy chairman for 28 years. Mr. Allen, who was 85, was High Sheriff of Bedfordshire in 1925.

Mr. A. C. HARTLEY, president of the Institution of Civil Engineers since November and a past president of the Institution of Mechanical Engineers, died on Thursday of last week. He was 71. The early part of his career was spent with the chief engineer of the North Eastern Railway, Hull Docks, Rose, Downs & Thompson, Limited, Hull engineers and ironfounders, and as a partner in the firm of Maxted & Knott, consulting engineers. Since 1924 he became closely associated with oil engineering and he was well known for his wartime inventions of "Pluto" and "Fido."

A MODERNIZATION PLAN costing more than £2,000,000 is being pressed forward by British Railways in the Newport (Mon) area to coincide with the start of production at the new Spencer steelworks at Llanwern in the autumn of 1961. One modern box at Newport station will replace 14 signal boxes and a colour light signal system will operate. Existing lines will be altered to give two uninterrupted lines from Cardiff to beyond the works site. Speed limit of goods trains will be raised from 10 to 40 m.p.h. and it is expected that 150 more trains a day will be handled than at present.

Personal

BISRA's New Assistant Director

IT is announced that Mr. S. S. CARLISLE, head of the physics department of the British Iron and Steel Research Association, has been appointed an assistant director. He will be especially concerned with the co-ordination of BISRA's work on automation and information handling, now a vital part of the research programme.

MR. S. S. CARLISLE

He graduated in electrical engineering at the College of Technology, Queen's University, Belfast, and gained his M.Sc. degree in 1942. He joined BISRA in 1946 and a year later was appointed head of the instruments section of the physics department and in 1954 head of the South Wales laboratories. His work was particularly concerned with new measuring and control systems for furnaces, steel coatings, and continuous strip processing in the manufacture of tinplate.

Mr. Carlisle returned to London in 1958 to take up his recent post. Last year he was a member of an Institution of Electrical Engineers and British Council delegation to Russia to study automation research and development in Soviet industry. His new post with BISRA will include co-operation with laboratories and firms outside the association with a view to increasing overall research and development effort devoted to automation in the steel industry. He has served on the council of the Society of Instrument Technology and is a past chairman of the society's South Wales section.

Mr. J. A. HAMPSON, deputy marketing director of the West Midlands Divisional Coal Board, is the new chairman of the Midland region of the Coal Utilization Council.

Dr. HERMANN REUSCH, managing director of the West German steel concern, Gutehoffnungshütte, has been made a Commander of the Sylvester Order by Pope John XXIII.

Presentations were made at a farewell luncheon in Sheffield on Tuesday by Mr. N. Lingwood, distribution director of British Oxygen Gases, Limited, to Mr. H. TOWNEND, district sales manager, who is retiring after 41 years' service with the company.

To mark the completion of 62 years' service with Ephraim Phillips, Limited, screw manufacturers, of Birmingham, the chairman, Mr. H. T. PHILLIPS, received a presentation from his son, Mr. D. H. Phillips, joint managing director, at a recent works dinner.

Mr. E. W. HAGUE, who has retired from the board of Thos. Firth & John Brown, Limited, Sheffield steelmakers, joined the company in 1914 and was appointed a local director in 1947. Four years later he became director responsible for sales. Mr. Hague is chairman of Agence Acieries Firth (Sheffield), Limited, and Nitralloy, Limited, and a director of F.B. Engineers, Limited.

Mr. J. A. GODDARD, a director and secretary of Fry's Diecastings, Limited, London, S.W.19, has been elected chairman of the Zinc Alloy Die Casters' Association for 1960. He succeeds Mr. K. J. WHITEHEAD, joint managing director of Wolverhampton Die Casting Company, Limited.

Mr. ARTHUR CHAMBERLAIN, a director of J. Brockhouse & Company, Limited, the West Bromwich dropforgers, etc., has joined the board of Guy Motors, Limited. Another new director of that company is Mr. J. J. PARKES, who is chairman and managing director of Alvis, Limited.

Sir HAROLD SMITH, who retired as chairman of the Gas Council at the end of last year after more than 50 years in the gas industry, has joined the board of the Milford Docks Company, Limited, and has been elected chairman. He succeeds Mr. F. G. MITCHELL, who has resigned from the board owing to ill-health.

Mr. HUGH BEVERIDGE, who has been undermanager of the surface mine at Kinglassie Colliery (Fife) for several years, has left to become undermanager at Valleyfield Colliery (Fife). During the past year, Mr. Beveridge has been in charge of the mechanized faces in the surface mine, which uses the scraper system.

Ald. THOMAS DAY, an executive of Thomas Broadbent & Sons, Limited, electrical and mechanical engineers, of Huddersfield, has been elected the next Mayor of Huddersfield. Ald. Day is in charge of the firm's works apprentices' scheme.

A bronze plaque, showing the head and shoulders of Sir ERNEST CANNING, has been placed in the hall at the head office of W. Canning & Company, Limited, the Birmingham manufacturers of electro-plating plant, etc. It will supplement two scholarships at Birmingham University as a mark of Sir Ernest's 66 years' association with the company.

THE Messel Medal, senior award of the Society of Chemical Industry, will be presented to the 1960 recipient, Viscount CHANDOS, at the society's annual meeting in Bristol on July 6. The medal is awarded every two years in gold for meritorious distinction in science, literature, industry, or public affairs. Lord Chandos, chairman of Associated Electrical Industries, Limited, arrived at London Airport on Wednesday after a tour of India which involved travelling 20,000 miles in less than a month.

Mr. RUBEN VINER, president of Sheffield Cutlery Manufacturers' Association, and managing director of the Viner Group of companies, presented the Duchess of Gloucester with pieces of Sheffield cutlery when she opened the International Gifts and Fancy Goods Fair at Blackpool on Monday. The gift, accepted by the Duchess on behalf of the British Limbless Ex-Servicemen's Homes, comprised "Silver Dawn" stainless steel cutlery.

Mr. HUGH HOGARTH, a director of the Tharsis Sulphur & Copper Company, Limited, Glasgow, and of a number of shipping firms, has been nominated to succeed Sir Nicholas Cayzer as president of the UK Chamber of Shipping. Mr. W. ERRINGTON KEVILLE, a deputy chairman of Furness Withy & Company, Limited, and Shaw Savill & Albion Company, Limited, and a member of several shipping industry organizations, has been nominated as vice-president.

Mr. STANLEY PEARCE, who since 1945 has been export sales manager of F. Perkins, Limited, diesel engine manufacturers, of Peterborough, has retired at the age of 69. From 1909 until 1914, Mr. Pearce was associated with his uncle's agricultural machinery manufacturing business in Russia. After Army service

in England, he returned to Russia in 1916 to work on munitions' manufacture, leaving during the Russian Revolution. Afterwards, he held appointments in Europe and South America and later formed his own import-export business in London.

New directors of the Glasgow Chamber of Commerce include Mr. THOMAS COUGHTRIE and Mr. JOHN RANNIE. Mr. Coughtrie is the founder and chairman of the Belmos Company, Limited, colliery and industrial switchgear manufacturers, of Bellshill (Lanarkshire), and was recently appointed chairman of the North British Locomotive Company, Limited. Mr. Rannie, who is shipyard director of John Brown & Company (Clydebank), Limited, was re-elected president of the Clyde Shipbuilders' Association last October and in November became senior vice-president of the Shipbuilding Employers' Federation.

Recent Wills

CUMPSTY, J. H., late a director of Blackwell's Metallurgical Works, Limited, Liverpool £17,328

WALKER, S. J., one of the founders of Richd. W. Carr & Company, Limited, steel and tool makers, of Sheffield £10,451

WINSKILL, J. R., former chairman and managing director of Walter Spencer & Company, Limited, steelmakers, etc., of Sheffield £27,890

HALL, WILLIAM, former foundry manager at the Ecclesfield works of the Brightside Foundry & Engineering Company, Limited, Sheffield £10,336

PRICKETT, T. W., chairman of Atkinson & Prickett, Limited, shipowners, brokers, and coal exporters, of Hull, Goole, Immingham, and Grimsby £101,552

HOLMES, CHARLES, connected with the steel industry in Sheffield for more than 50 years and late manager of Thos. Firth & John Brown, Limited £7,726

PARKINSON, G. H., sales director of Ley's Malleable Castings Company, Limited, Derby, and a director of its associate company, the Ewart Chainbelt Company, Limited £60,166

GARLAND, J. L., managing director of James Waldie & Sons, Limited, coal merchants and former coalmasters with business interests in Scotland and the north of England £18,079

WILSON, H. G. C., chairman and managing director of John Harris Tools, Limited, Warwick, and a vice-chairman and former treasurer of the Gauge and Tool Makers' Association £83,707

SMITH, C. J., of Falmouth (Cornwall), retired constructional engineer, founder and late chairman of Sherratt & Smith, Limited, structural engineers, of Pendleton, Salford (Lancs) £29,392

CHAMBERLAIN, W. E., chairman and managing director of the Chamberlain group of companies, which serves civil engineering and allied fields and which includes Chamberlain Industries, Limited, mechanical engineers, makers of cranes, etc., of London, E.10 ... ... £183,931

TIZARD, SIR HENRY THOMAS, FRS, principal scientific adviser to the Government, 1946-52, chairman of the Advisory Council on Scientific Policy and the Defence Research Policy Committee, and a director of Albright & Wilson, Limited, industrial chemical manufacturers, of Oldbury (Staffs), Blaw Knox, Limited, makers of steelworks and furnace plant and equipment, of London, S.W.5 £31,610

BRAITHWAITE, MAJOR SIR ALBERT, Conservative MP for Harrow West, who had specialized knowledge of fuel and power matters and of trade and industry generally and who was chairman of Sterling Electric Holdings, Limited, William Moseley (Engineers), Limited, and a director of the Parkinson Strip Mining Company, Limited. Sir Lindsay Parkinson & Company, Limited, Sterling Engineering Company, Limited, and other companies £122,287

INTESTATE

MARTIN, A. J., of Weldon (Northants), an assistant secretary of Stewarts and Lloyds, Limited ... £16,558

A LARGE-SCALE experimental installation costing some £300,000 has almost entirely eliminated smoke from the Thomas units at the West German Huckingen steelworks of Mannesmann, AG.

Coalfield News

Gedling Colliery's Future Assured "For Many Years"

ASSURANCE that there was no chance of Gedling Colliery, Nottingham, "working itself out of a job"—as had been reported of a west Derbyshire pit—was given by Mr. Rex Ringham, chairman of the East Midlands Divisional Coal Board, on Saturday when he officially opened the colliery's £260,000 office block and pithead bath extensions. Gedling could go on producing 1,000,000 tons a year for many years, he said. It had been worth waiting a long time for the baths for now they had been supplied with all the very latest equipment and were second to none.

Mr. Albert Martin, secretary of the Nottinghamshire Area branch of the NUM, paid tribute to the good relations between management and unions—"the envy of Europe and the rest of the world." It was silly, he said, to say there was no future in mining when the country's economy was founded on coal. "If something better were discovered I would be the first to say: 'Take the men out of the filth and grime of the pits,' but what else is there?" he asked.

Other speakers included Mr. N. R. Smith, Area general manager of No. 6 Area, and Mr. E. Bradley, Gedling NUM branch secretary. In the absence owing to illness of the manager of Gedling, Mr. T. J. R. Sales, the deputy manager, Mr. G. W. Rogers, presided.

AGAINST THE ADVICE of their leaders, delegates to the Yorkshire area conference of the National Association of Colliery Overmen, Deputies, and Shotfirers voted overwhelmingly at Barnsley on Saturday in favour of another pay claim for all under-officials in the industry. Their last increase was in 1957, which made the minimum weekly wage of a Grade 1 deputy £18 13s. The new claim will be considered at the association's annual conference in April.

COWDENBEATH NO. 7 COLLIERY, the oldest in the district, closed down last Friday after the last shift came up. The colliery is believed to be nearly 100 years old. Of the 334 men employed there, 91 have been retained for salvage work and maintenance. Another 214 are to be transferred to other pits, mostly in West Fife. Six men have retired and four others have themselves found different work. A NCB official said that nobody would become redundant because of the close-down.

THE THREE HUMBER PORTS of Grimsby, Immingham, and Goole exported lower tonnages of coal, coke, and patent fuel in 1959 than in the previous year. Grimsby shipped 383,587 (874,413) tons, Immingham, 1,261,700 (1,827,657) tons, and Goole, 1,671,595 (1,776,517) tons. Shipments in the four weeks ended December 27 from the three ports were:—Grimsby, 23,915 tons (62,142 tons in the corresponding period of 1958); Immingham, 91,716 (114,499) tons, and Goole, 103,903 (144,186) tons.

A CENTURY AND A HALF of mining at the village of Gilfach Goch (Glam) came to an end last Friday with the closing of the Britannic Colliery. On Monday about 180 men from this pit started work at Cwm, Coedely, and Maritime collieries, all in east Glamorgan, but the gradual transfer of men from Britannic had already been in progress for many months under the Cwm Colliery integration scheme. About 100 men and officials will remain at Britannic for about a year for dismantling work before being absorbed into other local pits.

Company Meeting

COLVILLES LIMITED

Profit Again Benefits from Operations at Ravenscraig

BALANCE-SHEET SHOWS SATISFACTORY LIQUID POSITION

Modernization Bears Fruit

THE 29th annual general meeting of Colvilles Limited is being held today (Friday) at Glasgow.

The following is the circulated statement by SIR ANDREW MCCANCE, D.Sc., LL.D., F.R.S., D.L., chairman and managing director, for the year to September 30, 1959:—

It is a matter of great regret to record that Mr. Robert Marshall, who had to retire from the Board a year ago owing to ill-health, passed away in the autumn of last year. His association with Colvilles goes back for many years and throughout the steel industry he was widely known and greatly respected.

Accounts

The manufacturing and trading profit has again benefited from the economic operations at Ravenscraig in spite of a reduced demand. The policy of spending money during the post-war years on modernization and on modifications to the established works is now bearing fruit. We have been able to maintain the works at less cost without in any way lowering standards. The reduction in pressure on producing departments, in consequence of the recession, enabled some accumulation of lower priced stocks of semi-finished and finished materials to be liquidated. These factors have all contributed to the improved trading results.

For some time the Board had been considering the desirability of introducing a scheme of pensions for workers, which would contribute to their greater security by making provision for the future and would enable them to enjoy additional benefits when the time came for retiral. On September 1, 1959, in association with the Scottish Amicable Life Assurance Society, a scheme for pensions and life assurance for male employees was introduced, which has met with a warm welcome throughout the Colville group. No contributions are required from employees, but the scheme allows members to make voluntary contributions to obtain additional benefits for themselves. The Board have been encouraged and gratified at the very large percentage of the employees who have availed themselves of this provision. The scheme has been designed to fit in readily to the Government's national scheme. This first year it was considered preferable to charge a full year's premium to the accounts rather than make a strict accounting apportionment. In this way the accounts show the measure of the annual charge that can be expected in future to cover this scheme of social betterment for those who work for the company.

Since it cannot be assumed that the future will be free from inflation, it has been decided to set aside £2,000,000 to capital reserve replacement of assets with the intention of augmenting the depreciation which is still based to some extent on the historical cost of plant at pre-war levels.

The provision for taxation this year is less than that for last year. This is in part explained by the reduction in the standard rate of income tax and by a favourable settlement in the Courts of a case which had a bearing on the adjustment of our own profits. The taxation for the remaining post-war years has now been settled apart from the adjustment of the profits tax for the period when the company was a member of the Iron and Steel Holding and Realization Agency group. In consequence, certain provisions are now no longer necessary and they have been added back to the profit and loss account. The net profits this year have been increased by those non-recurring items.

When the construction of Ravenscraig was started, investment allowances were in force, but shortly afterwards these were terminated and replaced by the grant of initial allowances. More recently a dual system involving both allowances was introduced. These changes gave rise to some dubiety in their application to a large capital development like Ravenscraig where construction was spread over several years. I am glad, however, to report that all questions in this connection have now been settled and a substantial part of the amount of £1,336,623 added back as provision for tax no longer required, arose from such settlements.

The balance-sheet shows a satisfactory liquid position, although it should be stated that substantial cash resources will be required for our capital commitments. The capital commitments stated on the balance-sheet are our present firm commitments. They do not reflect all the expenditure involved in the new strip mill and other development plans, the orders for which are now nearing the final stages of their technical adjustment. The contracts for the hot and cold mills have been placed, together with their electric drives. By the time the annual meeting takes place, the commitments for the blast furnace and coke ovens, buildings, and steelmaking plant will all have been finally concluded. These items in total will cover approximately two-thirds of the total estimated expenditure. Having such commitments in mind, £3,000,000 has been transferred to general reserve.

The Board recommended that a final dividend of 8 per cent. be paid to make a total of 14 per cent. for the year.

Subsidiary Companies

Like the parent company the subsidiary companies felt the effects of the recession during the early part

of the present year, but I am glad to say they have shared in the recovery which has since followed. The greater part of their earnings has been transferred by way of dividend to strengthen the cash reserves of the parent company in anticipation of our commitments for development which, with the progress in construction, will require steadily increasing payments in the coming year.

In the case of The Lanarkshire Steel Company, Limited, whose principal products are steel joists and heavy sections, the effect of the recession was increased owing to changes in the type of joist in demand. The availability of universal beams in this country reduced the sale of normal joists manufactured to British Standard Specifications, which are not only heavier for the same strength but are also less convenient in other ways. The consequences of such a development had been under close consideration for some time and experiments to produce the new profile in the ordinary section mill had been in progress for the past three years. I am glad to say that in this the company was successful and it has been shown that with the addition to the existing mill of universal stands and run-out roller tables a full range of universal beams up to 24 in. deep can be produced. The order for these additions has been placed and it is anticipated that their installation will be completed and in production in about 15 months' time. When completed the range and type of joist and section which the company can market will be greatly extended. This should place the company in a favourable position in regard to home and export markets in the future.

New contracts for constructional steel have been scarce in recent years. In part this is but another aspect of the recession in trade through which the country has been passing, but it is also a reflection of competition from ferro-concrete construction which has been growing in spite of the trade setback. The proportion of buildings erected in ferro-concrete has always been less in Britain than in continental countries and it would seem that this difference is now being narrowed. This is confirmed by the demand for ferro-concrete bars, the output of which from the bar mills in the group has reached record tonnages in recent months.

The insistence in building regulations on casing steel columns in concrete for fire protection, without permitting the added strength of the concrete to be taken into account, has had an unfavourable effect on the cost of steel frame buildings and has made their use uncompetitive in many cases. This, I am glad to say, has now been put right and with the advent of universal beams I fully anticipate that steel construction will now become more competitive than has previously been possible.

The Colville Constructional Company, Limited, with their diversified production have had a satisfactory year and can look forward to an active period from the contracts placed with them for the buildings required for our strip mill scheme. In welded fabrication for engineering components, their works have been fully employed during the year. A large contract for fabricated valves for an atomic energy power station is nearing completion, but, in common with the experience of others in this field, the work has not proved remunerative.

With the record British production of motor-cars, demand for special steels has been good during recent months and The Clyde Alloy Steel Company, Limited, are producing their full quota of the supplies required by this virile industry. Looking at the steady growth in production which has continued in the motor industry, the need for a larger output of special steels was foreseen some time ago and steps were taken to rebuild the Hallside Works of The Steel Company of Scotland, Limited, to form a modern and economic unit laid out and specially designed for the production of these highly diversified steel compositions. This has been an operation of some magnitude, but it has progressed steadily. The falling away in trade, which applied to special steels equally with other qualities, has enabled the reconstruction work to be carried through without undue pressure and therefore with reasonable economy. The location at Hallside was satisfactory, but the layout of the works and the plant were not in line with modern ideas. All this has now been changed. The new mills are nearing completion and the modernization of the melting shop is in progress. It has been decided to instal an 80-ton electric furnace and experience with this, particularly in regard to production costs, will be awaited before deciding on any further extension in the use of this type of large furnace.

The management and control of this division have been transferred to The Clyde Alloy Steel Company, Limited, who are also integrating the steelfoundry production at Hallside with their own. As from the current year, the results relating to these activities will be included in those of this subsidiary.

Correspondingly, the plate production of The Steel Company of Scotland, Limited, at Blochairn Works has been amalgamated with the plate production of Colvilles and is now controlled from the head office of the parent company.

Plans are in progress for expanding the production of bright-turned and bright-drawn bars from the Govan Shafting and Engineering Works and merging this with a similar but somewhat more restricted class of work now carried on at Dalzell Works, Motherwell.

It is anticipated that these changes will result in administrative and production economies. The increasing use now being made of mechanized methods in office control and accounts has of necessity compelled greater centralization and a greater concentration of work in fewer centres.

After a very slack period the hand mills of Smith & McLean, Limited, at Gartcosh are now well employed helping to meet the shortage in the supply of sheets. When strip mill sheets were available, users were no longer contented with hand mill quality, but the recurrence of demand is helping to bridge the time before the strip mill comes into operation. These changes, however, are recognized as being conditioned by the fluctuation in the state of supply and demand and, in competition with the superior quality of the strip mill product, the future prospects for the hand mills have not been changed by this temporary demand. To those directly interested, however, it is a very welcome respite. The galvanizing units at Mavisbank have been suffering from the falling-off in orders, but have been able to maintain a reasonable level of work and they are now fairly fully committed for some months ahead.

The only other subsidiary I need refer to is The Carnlough Lime Company, Limited. During the last few years the equipment has been modernized and the methods of handling at the quarry improved in order to meet the increasing demand for small limestone arising from the greater use of sinter in our own blast furnaces. There is a limit, however, to the output that can be obtained from the quarries without resorting to mining, which would not be economic, and our plans pitch the future output no higher than the present economic limit. This smaller member of

our subsidiary group, as a result of the changes which have been made in recent years, is at last giving a satisfactory return on the capital invested.

I am glad to be able to state that all the subsidiary companies have this year earned profits. Apart from small balances added to the amounts carried forward, these profits have been transferred to the parent company.

Production and Costs

The production of coke, pig-iron, and steel during the past financial year has been:—

	Six months to March 31.	Six months to September 30.	Total.
	Tons.	Tons.	Tons.
Coke ..	251,082	217,050	468,132
Pig-iron ..	344,256	328,907	673,163
Steel ..	705,246	737,066	1,442,312

These figures reflect the reduced demand which existed during the period. In addition, however, coke and pig-iron production at Clyde Iron Works was affected by substantial rebuilding and relining operations. When it became evident that a reduced demand would continue for some time, the opportunity was taken to close down two batteries of coke ovens which had been in continuous production for 20 years and were in need of reconstruction. While reconstruction could probably have been delayed for a few more years, it was considered that rebuilding might then have been required at a time when the pressure of demand would have made it inconvenient. The reconstruction is now completed and several improvements have been introduced to make the new batteries modern in every respect. The total cost has amounted to £667,863 and, in view of the improvements, this sum has been charged to capital account in conformity with the national agreement with the Inland Revenue. A reconditioning fund of £317,605 had been accumulated over the years and, being no longer required, has been returned to the revenue account.

Two of the blast furnaces were also shut down and relined and the opportunity has been taken to convert a second furnace not yet adapted for high top pressure blowing. During the period of relining, steelmaking was continued from stocks of pig-iron accumulated for this purpose. At the beginning of September, one of the blast furnaces was again brought back into operation. The total tonnage of pig-iron produced in this furnace during the 10½ years of continuous use was 2,352,136 tons, which is believed to be a record for this country.

We have now had the benefit of a full year's operation of the ore unloading plant at General Terminus. The rate of unloading has come up fully to expectations and large cargoes have been handled expeditiously. The largest single cargo of ore discharged so far has been 24,000 tons brought in by a 35,000-ton ore carrier. Experience has demonstrated that the plant would be capable of still better discharge rates if the conveyor belts were speeded up by the use of motors of higher horsepower and this change is now in progress.

At Glengarnock Works the last steam engine driving the section mill has been scrapped and replaced by an electric drive with beneficial effects to the cost of rolling, in spite of the fact that much of the steam came from waste heat. The conversion of this rolling mill completes the electrification plans for our mills, which have been in progress now for some years and which have been carried through in every case without sensible loss of production.

Development

A preliminary scheme for the new strip mill was approved by the Iron and Steel Board and the British Iron and Steel Federation in April, 1959. This enables negotiations for the purchase of the plant to begin with the manufacturers. Throughout the year visits have been paid by teams of engineers and metallurgists to corresponding installations in this country and I would like to express appreciation for all the assistance which has been freely given and which has proved most helpful. In addition, visits have been paid to America, Holland, Germany, Italy, Belgium, and Austria, and, as a result of a careful study, it was decided to instal L-D oxygen converters with lime injection to increase the steelmaking capacity at Ravenscraig by 700,000 tons, which, with the addition to the present open-hearth shop of a fourth furnace already planned, will give a total annual production of 1,260,000 tons at that works.

Large quantities of oxygen will be required and negotiations are being concluded with the British Oxygen Company, Limited, for the erection of a plant to produce 200 tons of liquid oxygen per day. A second plant with the same capacity will follow immediately afterwards to enable the application of oxygen to be further extended to the melting shops at Dalzell and Lanarkshire Works.

Good progress is being made with the construction of the slabbing mill, and the integration of production from this mill with the requirements of the strip mill has been made without difficulty.

A more detailed examination of the probable market has shown that our original production targets were too low and a revision has been necessary. The target output for the mill is now 500,000 tons of finished sheets and 175,000 tons of light plates. The hot mill itself will produce finished strip up to 60 in. wide as this was considered the most useful width to meet the general demand. Before the width of the mill was finally determined, a study of the present requirements was made and consultation took place with the principal users. As a result, the conclusion was reached that the demand for sheets in excess of this width was so moderate a percentage of the total demand that expenditure on the duplication of facilities for the supply of very wide sheets would not be justified.

Following the changes mentioned above, it was found necessary to instal a 4-stand tandem cold reduction mill at Gartcosh of the same width as the hot strip mill. This mill will have ample latent capacity to meet any likely increase in demand that may arise at a later date. Work has already started on the preparation of the site at Gartcosh and good progress has been made. It is anticipated that the cold reduction plant will be completed by the end of 1961, and the hot strip mill by the third quarter of 1962.

I am glad to be able to state that most of the staff positions for the control and supervision of our increased steel production and for the strip mill are being filled from within our own organization. Arrangements have been made or are in process to enable those selected for such positions to obtain training in operational practice both at home and abroad in order that they may be adequately equipped to take over their new responsibilities when the construction of the strip mill is completed.

The opportunity occurred during the year of acquiring the site and buildings belonging to Hurst, Nelson

& Company, Limited, at Motherwell and the purchase was concluded. This land adjoins the land of Lanarkshire Works on the one side and that of Dalzell Works on the other, while to the north it is bounded by the railway sidings of Ravenscraig. Its purchase will, therefore, enable improvements to be made in the access to all these works as and when required. The possibility of utilizing some of the area and buildings to develop and extend the production of turned and bright drawn bars and certain other products is now being examined.

Production of coke and pig-iron ceased at Dixon's Ironworks, Limited, in November, 1958, although trading in coke continues. Work has now started on dismantling the plant and clearing the site. Interest in the re-utilization of the site has been shown and negotiations for its sale are proceeding. Meantime, agreement has been reached on the purchase by another concern of approximately one-third of the area for the erection of a substantial modern factory.

Raw Materials

For some years it has been recognized that the increase in our pig-iron production would demand larger quantities of limestone, and exploration work has been carried out over a wide area in Scotland to find a suitable deposit for these additional requirements. Unfortunately, none of the Scottish deposits has been found suitable in quality: all contained numerous sand streaks throughout, which render them unsuitable for steelmaking. Nor are the reserves at Carnlough sufficient for our larger requirements. A deposit located near Penrith has been extensively explored and work carried out during the past three years has confirmed the suitability of this limestone. An option has been taken on the site. A scheme for the development of this reserve by modern methods and its transport to the works is now under active consideration, and it is planned to have supplies available by the time the additional blast furnaces at Ravenscraig have been constructed.

From time to time public reference has been made to deposits of iron ore in Scotland and we have thought it desirable that the known deposits should be thoroughly explored to determine whether they contain any potentiality as a supply for our works. The particular deposits which justified examination were those on the Island of Raasay and the Island of Tiree. This work has now been completed and it has been found that, while the deposit on the surface at Tiree gave promising indications of iron content, the disseminated rock containing the ironstone was irregular and fell away rapidly in iron content with the depth from which samples were taken. Extensive boring has shown that this falling away in value would make the Tiree deposit uneconomic to develop.

The iron-ore deposit on the Island of Raasay, which was worked for some years by another Scottish iron-making company, has been closely studied. It has a low iron and a very high phosphorus content and the cost of steelmaking with pig-iron from this iron ore would be so high as to limit seriously the commercial prospects of its use. It is a matter of regret that no economic workable iron deposit is known to exist in Scotland.

Future Outlook

While the year under review commenced in the midst of a trade recession, the recovery since it started has been rapid. The demand for steel has been rising steadily during the past half year and there is every indication that this is likely to continue. This change reflects the increasing confidence in the trade prospects of the United Kingdom, both in the field of home trade and in the export markets. It is a reflection of the confidence which has grown with the evidence of stability in costs and prices engendered by the success of the Government's economic policies.

APPENDIX

ANALYSIS OF INCOME AND EXPENDITURE

	1959 (£,000).	1958 (£,000).
Income from sales, interest, etc.	58,600	75,480
Cost of materials, trade expenses, and services bought	23,680	36,247
Cost of fuel	9,578	13,883
Depreciation	2,462	2,500
Debenture interest	794	643
	36,514	53,273
Balance available for wages, salaries, taxation, dividends, and re-investment by way of reserves	22,086	22,207
Distributed as follows—		
Wages, salaries, national insurance, and superannuation contributions	11,496	13,223
Taxation	3,025	3,791
Dividends—gross	1,672	1,520
Reserves	5,893	3,673
	22,086	22,207

Note.—Since wages and salaries are paid before deduction of tax dividends have been treated on the same basis and the amount of taxation has been adjusted accordingly.

Number of Employees, 16,500. Number of Shareholders, 36,500.

The state of trade is very sensitive to changes in public sentiment and can be adversely affected by unrest and by wages demands which do not have increased productivity as their justification. There have been some signs recently that the pressures which caused the inflationary increases in the cost of living during the post-war years may recur and may upset the stability which has brought the return of good trade and employment from which we are now all benefiting. It is to be hoped that counsels of restraint in such matters will be followed so that the present expectations of prosperity throughout the country may be encouraged and prolonged.

Our position as an exporter of steel products has been well maintained and new markets are being opened up which offer good prospects for future business. The development of such new markets is essential to offset the diminishing demand from certain traditional markets in countries now establishing their own steel plants.

The Board have once again been excellently supported during a period which has not been easy by an able and enthusiastic staff and they wish to record their sincere appreciation for the great assistance they have received from everyone in the service of the company.

EMI Withdraws Offer for Lancashire Dynamo

METAL INDUSTRIES, LIMITED, which has been bidding against Electrical & Musical Industries, Limited, for Lancashire Dynamo Holdings, Limited, declared its offer unconditional last weekend. Both offers were attractive and holders appeared to resolve the problem as to which to accept by selling through the market. Mr. John Black, deputy chairman of MI, said that his board was given confidence in making the announcement in view of the holding already acquired through the market, the encouraging way in which acceptances were coming in, and the substantial promises of support.

It is believed that last Friday about 500,000 £1 ordinary shares worth about £2,000,000 changed hands with the price of Lancashire Dynamo shares rising to a new high level. Sir Joseph Lockwood, chairman of EMI, said the position would be considered, but his company was not prepared to pay "over the odds."

The EMI directors announced on Monday that in view of the response to their offer and of the substantial buying in the market at above the offer price, the company was withdrawing its offer and releasing stockholders of Lancashire Dynamo who had accepted it. The EMI offer, they added, was the highest price which they were prepared to pay for the business, and they "were not prepared to pay to individual stockholders a price not offered to all other stockholders."

Commenting on EMI's withdrawal of its offer, Mr. John Black said: "I am immensely heartened by this news. By coming together we shall be in a position to provide industry with the most complete and advanced techniques in automation."

Closing date for MI's offer has been extended to February 9.

ENGINEERING AND ADMINISTRATIVE departments of Stein & Atkinson, Limited, combustion engineers and furnace designers and constructors, are now housed in a new four-storey block of offices at Westminster House, Kew Road, Richmond (Surrey).

Trends in European Steel Production

LONG-TERM trends and problems in the European steel industry have been reviewed by the Steel Committee of the United Nations Economic Commission for Europe which has also considered developments in the European steel market in 1959. A substantial part of its recent session was devoted to the trends and problems which were the subject of an inquiry undertaken by the ECE Secretariat.

The results of the inquiry, which is regarded as a major project in the committee's programme, are to be published in the spring. A provisional version of the review of the European steel market in 1959 will be considered at the committee's next session in June, when the agenda will also include discussion on the proposals on the automation of rolling and finishing of steel and productivity in the steel industry made by the USSR delegation, and a note to be prepared by the US delegation elaborating its proposal on competitive factors affecting trade in steel products.

The committee's current work programme will include an inquiry into the use of steel in the building and civil engineering industries, and an inquiry into the relative contribution to total crude steel output of the different steelmaking processes in the light of their respective economic and technical advantages, with particular attention to the growing use of oxygen in the different forms of steelmaking. Studies on the effects of location on iron- and steel-making costs, the economic aspects of iron-ore preparation, and the long-term trends in the replacement of steel by other materials have been included in the long-term work programme.

The committee has requested the secretariat to examine in consultation with the secretariats of other international organizations the work being done on the definition of alloy steels with a view to arriving at an agreed system of classsification as a basis for future work in this field.

Mr. H. W. A. Waring (UK) and Mr. F. Houdek (Czechoslovakia) were re-elected the committee's chairman and vice-chairman, respectively. Mr. Waring is managing director of Brymbo Steel Works, Limited, and an executive director of the Guest, Keen & Nettlefolds, Limited, group export services organization. He is the first British chairman of the committee.

ARTHUR LEE & SONS' BID FOR JOHN SHAW

AN offer worth more than £400,000 for the 33,000 ordinary shares of John Shaw, Limited, wire rope manufacturers, of Worksop, is being made by Arthur Lee & Sons, Limited, steelmakers, etc., of Sheffield.

For every £1 ordinary share in John Shaw, 26 ordinary shares of 2s. 6d. are being offered, each fully paid in the capital of Arthur Lee plus £2 9s. in cash. As Arthur Lee proposes to make, before the implementation of this offer, a one-for-one scrip issue to its ordinary shareholders, these 26 shares are the equivalent of 13 ordinary shares at present.

The directors of John Shaw have agreed to accept the Arthur Lee offer in respect of their own holdings of 9,495 shares, and recommend all other holders to do likewise.

News in Brief

FIVE ROPE-DRIVEN conveyor installations have been installed in Japanese coal mines by Cable Belt, Limited, Inverness.

NEW BUILDINGS of the Mining Department of the University College of South Wales and Monmouthshire, Cardiff, will be opened on March 11 by the Duke of Edinburgh, who is Chancellor of the University of Wales.

AUSTRIA INCREASED its output of raw steel by 5 per cent. last year, the 1959 total of 2,520,000 beating that of the previous record year (1957) by 110,000 tons. Pig-iron output was up by 1 per cent. to 1,840,000 tons.

CHIEF SPEAKER at a trade luncheon of the Gauge and Tool Makers' Association, to be held at the Savoy Hotel, London, W.C.2, on March 31, will be Mr. John Rodgers, Parliamentary Secretary to the Board of Trade.

SOME 74 COKE FURNACES have been ordered by the Kawasaki Steelworks, Chiba, near Tokio, and 25 furnaces by the Mitsubishi concern of Kurosaki, from the West German firm of Dr. C. Otto & Company, GmbH.

TWO FURTHER "Introduction to Industry" training courses have been arranged for April at the Chippenham works of the Westinghouse Brake & Signal Company, Limited. The courses are available to boys taking "A" level science subjects.

AN OIL ENGINE, manufactured by Ruston & Hornsby, Limited, has been in continuous use for 63 years. It started its working life in April, 1896, at Bunbury, Western Australia, providing power in an ice and soda water factory. It was soon transferred to a brickyard where it is still operating.

AT A ONE-DAY sales convention held by the Plessey Company, Limited, telephone, radio, electronic, and instrument manufacturers, of Ilford (Essex), at its Swindon factory recently over 100 executives discussed subjects ranging from oversea selling to recent developments in the British aircraft industry.

ORE-MILLING at Rampgill Mill, Nenthead (Cumberland), will cease next January or February, Anglo-Austral Mines, Limited, has announced. This move follows the decision to close the company's fluorspar mine at Heights (Co. Durham) next September, when, it is estimated, the supply of ore will be exhausted.

SUPPLY OF a "substantial quantity" of avometers to Communist China is being negotiated by Avo, Limited, London, S.W.1, a company in the Metal Industries group. The contract is nearing completion. Avo is to take part in an exhibition in Moscow in June organized by the Scientific Instrument Manufacturers' Association.

GENERALLY, output during 1959 at the Ilseder Hütte steelworks, Peine, West Germany, was well up on 1958. Output of pig-iron was 683,000 (628,000) tons, raw steel 766,000 (698,000) tons, rolled steel 640,000 (581,000) tons, and crude iron ore 2,750,000 (2,550,000) tons. Coal output dropped to 1,310,000 (1,420,000) tons and coke to 736,000 (776,000) tons.

AN EXTENSIVE outfit of tools has been given by Stanley Works (Great Britain), Limited, joiners' tool manufacturers, of Sheffield, to the Oxford and Cambridge expedition which is to follow ancient caravan routes across the Sahara later this year. The team of seven undergraduates and a lecturer will conduct archæological and anthropological research.

LAST YEAR Russia produced 43,000,000 metric tons of pig-iron, 59,900,000 tons of raw steel, 47,000,000 tons of rolled steel, 94,400,000 tons of iron ore, 506,500,000 tons of coal, 53,400,000 tons of coke, 38,800,000 tons of cement, and 264,000,000,000 kW of electrical power. Coal output showed the smallest increase on 1958, the tonnage rise being only 2 per cent.

ONE OF THE OLDEST firms in Birmingham, Atkin & Sons (1931), Limited, saw and tool makers, celebrated its bicentenary with a dinner last Friday. The firm was founded by Aaron Atkin, an itinerant journeyman sawmaker, who walked from Sheffield to Birmingham with his three sons. A direct descendant, Mr. Howard Atkin, a former director and now part-time adviser, presided at the dinner.

NEW PREMISES in Birmingham Road, Chesterfield, are to be occupied in August by S. & J. Kitchin, Limited, agricultural tool manufacturers, of Sheffield. They will be treble the size of the firm's present works. About 100 of the staff of 150 are expected to transfer there and Chesterfield Corporation has agreed in principle to help with housing. There will also be an opportunity for local labour. The firm was founded in Sheffield in 1831.

ROTHERHAM WORKS of the Steel, Peech & Tozer branch of the United Steel Companies, Limited, was visited by about 5,000 people last year; 1,230 of them were from universities and 528 from technical societies. The total number of visits was 593, of which 105 were schools. The bar mill at Steel, Peech & Tozer had an output for the first time of over 5,000 tons in the week ended January 30. The total was 5,203 tons. The Templeborough finishing banks took delivery of 22,879 tons of billets in the same week, the previous highest being 22,695 tons.

Fletcher, Houston Group Plans New Purchase

PRODUCTS covering a wide field for the engineering industry are now manufactured by the Fletcher, Houston & Company, Limited, group, and plans are in hand to buy for £420,000 in cash another Midland company to add to the list of companies in the group working outside Fletcher, Houston's original field of ironfounding.

The chairman, Mr. Walter West, said that during the year to September 30, 1959, forgings, castings, and finished units for the motor industry contributed substantially to output. There was some slackness in the forge and foundry in the first six months, but demands on both departments increased steadily during the second half of the year to a state of high pressure. Output was maintained at a satisfactory level throughout the year in all other sections of the group.

An increase in authorized capital will be proposed to provide for the two-for-one scrip issue and give a reserve of unissued capital for possible future acquisitions. Members are told that the proposed capitalization issue does not imply that total dividend distribution for the current year will again be increased. Group net profits were higher in 1958-59 at £88,128 (£74,452) and the dividend is 80 (70) per cent.

PROF. MISHA BLACK, a senior partner of the Design Research Unit, has been appointed consultant designer to Claudgen, Limited, a subsidiary of the General Electric Company, Limited.

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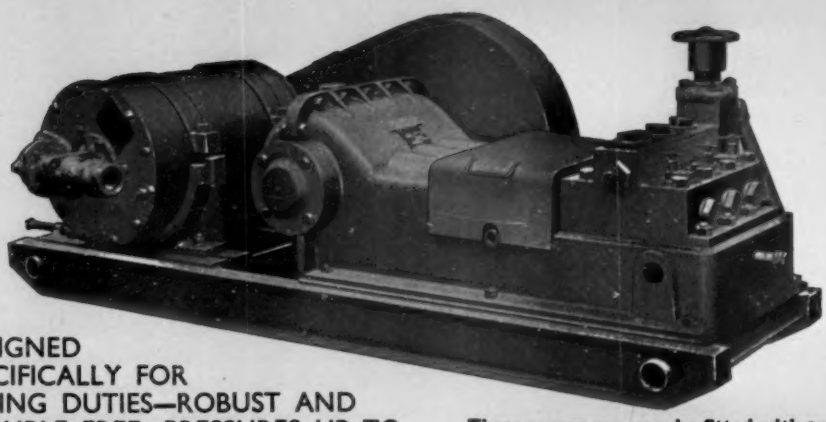

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CURRENT PRICES OF IRON AND STEEL

(Delivered, unless otherwise stated)
February 4, 1959

PIG-IRON

Foundry and Forge Iron.—No. 3 iron, Class 2, Middlesbrough, £21 6s.; Birmingham, £20 18s. 3d., 10-ton lots or over.

Low-phosphorus Iron.—Over 0·10% to 0·40% P, 10-ton lots or over, £23 5s., delivered Birmingham, £23 10s., delivered Grangemouth.

Basic Pig-iron.—Delivered in Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics, 10-ton lots or over, £20 3s.

Hematite.—Si up to 2%, S & P 0·03-0·05%; N.-E. (local iron), £24 14s.; Scotland (Scotch iron), Zone S.1, £25 0s. 6d.; Sheffield, £26 2s. 6d.; Birmingham, £26 9s.; Wales (Welsh iron), £24 14s., 10-ton lots or over in each case.

Refined.—Cylinder and refined irons, South Zone £25 9s., North Zone £25 6s. 6d. Refined malleable, max. 0·10% P, South Zone £26 9s., North Zone £26 6s. 6d.

MANUFACTURED IRON

(Bar basis, 2½ in. to ¾ in.)

CROWN IRON: England and Wales (Zone 1), £48 10s.; Scotland, £48 5s.; Ireland, f.o.q. Belfast, £50 7s. 6d.; all other Northern Ireland ports, £50 10s., f.o.q. Cable iron, £1 extra.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., 100 tons and over, £31 15s. 6d.; tested, 0·08-0·33% C, 6 to 35 tons, £33 15s. 6d.; hard (0·41-0·60% C), under 10 tons, £34 17s.; silico-manganese, under 10 tons, £43 16s. 6d.; free-cutting steel up to 0·25% C, under 10 tons, £36 14s. 6d. SIEMENS-MARTIN ACID (under 10 tons): Up to 0·25% C, £41 1s.; silico-manganese, £44 4s.

Billets, Blooms, and Slabs for Forging and Stamping.—Lots of under 10 tons. Basic, soft, up to 0·33% C, £38 10s.; basic, hard, over 0·41 up to 0·60% C, £39 12s. 6d.; acid, up to 0·25% C, £43 4s.; acid silico-manganese, £46 7s.

Alloy Steel (5 tons to under 10 tons).—BILLETS, 3 in., up to and including 10 in., for re-rolling, 0·6/1% Ni, £47 7s.; Ni 2·75/3·75%, Cr 0·5/1·10%, £74 5s.; Ni 2·75/3·75%, Cr 0·5/1·3%, Mo 0·2/0·65%, £84 14s. BARS: 1 in. dia. and up, nickel, £68 10s.; nickel-chrome, £99 4s.; nickel-chrome-molybdenum, £111 17s.

Other Semi-products, etc.—Forging ingots, up to 0·60% C, £31 12s. 6d. f.o.t.; tube billets, under 10 tons, £40 10s.; shell steel billets for direct forging up to and including 0·33% C, 100 tons and over, £37 15s.; tin bars and sheet bars, 50 tons and over, £32 10s. Wire rods, 3g. to 4g. (all areas except Birmingham, Scotland, Southern Joint Area, and Northern Ireland): Soft basic, under 50 tons, £41 2s.; hard basic, under 10 tons, £44 8s.; free-cutting, up to 0·25% C, £46 12s.; acid, up to 0·75% C, £54 14s. 6d. Stainless steel billets, 3 in. and over, 5 tons to under 10 tons, Austenitic, £229 10s.; martensitic, £141 10s.

FINISHED STEEL

Heavy Products (1 ton to under 10 tons).—Mild-steel plates, ordinary qualities, N.-E. Coast and Northern Joint Areas and Central Scotland, £42 2s.; medium plates, all areas of England and Wales, £45 11s. 6d.; boiler plates, N.-E. Coast and Northern Joint Areas and Central Scotland, £44 12s.; floor plates, N.-E. Coast, £43 11s. Sections (N.-E. Coast, Midland, and Northern Joint Areas, and Central Scotland): Angles, £39 16s. 6d.; bars (rounds and squares), £42 6s. 6d.; flats, £40 1s. 6d.; joists, £39 12s. 6d.

Rolled and Re-rolled Steel Products.—N.-E. Coast, Midland, Northern Joint, and South Wales Areas, and Central Scotland, 50 tons and over: Angles and tees, 4 un. in. and under, £40 18s. Channels, 3-in. web and under, £40 18s. Flats, 5 in. wide and under, and rounds and squares, under 3 in.: Untested soft basic, £39 1s.; free-cutting, £45 1s. 6d.; hard basic, £41 19s. 6d.; Siemens-Martin acid, £45 0s. 6d.; spring steel, basic, £44 4s. 6d.; spring steel, acid, £52 19s. Glazing tees, £47 0s. 6d. Sash and casement sections, £43 13s. 6d. Gate channels, £50 17s. 6d. Ferro-concrete bars (10 tons to under 500 tons), £39 10s.

Sheets and Strip.—Uncoated strip mill coils, hot rolled, under 3 mm. to 12g., mill run, mill edge, 25 tons to under 50 tons, £43 16s.; cold reduced, 17/20g., side trimmed, skin passed, £49 16s. Black sheets, 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £68 5s. Cold-rolled steel strip, coils, hard temper, not annealed, 10 tons to under 20 tons, £55 15s. Hot-rolled hoop and strip, u/t soft basic, 100 tons and over, £38.

Tinplates.—Cold reduced, hot dipped, 15 tons to under 50 tons, 67s. 4½d. per basis box of 108 lb., f.o.t. makers' works. Cold reduced electrolytic, 60s. 10½d. per basis box

Colliery Rails and Arches.—Arches, 4 in. × 2½ in. × 2 in., re-rolled £39 15s., 3 in. × 3 in., re-rolled £40, 3½ in. × 3½ in., re-rolled £40 7s. 6d., 4 in. × 2½ in. × 2 in., prime £44 6s. 9d. Other sections, prime £44 11s. 9d. Extra fishplates, £52 10s. Cambered girders, 4 in. × 2½ in. × 2 in., re-rolled £38 9s., 3 in. × 3 in., re-rolled £38 11s. 6d., 3½ in. × 3½ in., re-rolled £38 18s. 6d., 4 in. × 2½ in. × 2 in., prime £43 4s. Other sections, prime £43 6s. 6d. Benk bars, standard type, prime material, all thicknesses, £38 11s.; re-rolled, up to ⅝ in., inclusive, £37 6s.; over ⅝ in., £38 11s. "W" type bars, prime steel, all thicknesses, £41 1s.; re-rolled, up to ⅝ in., inclusive, £39 16s.; over ⅝ in., £41 1s.

Bright Steel (10 tons to under 20 tons).—Bars, no analysis or test, £52 8s. 6d.; flats, untested, £70 3s. 6d.

High-speed Tool Steel.—Finished bars, 5% cobalt, 10s. 10d.; 14% tungsten, 6s. 11d.; 18% tungsten, 7s. 9d.; 22% tungsten, 9s. 2d.; 4/6 quality molybdenum tungsten, 6s. 3d.; 6/6 quality molybdenum tungsten, 6s. 5d.; 5/6/2 quality molybdenum tungsten vanadium, 6s. 7d. per lb.

Rails, etc.—F.B. rails, heavy, 75 lb. to under 90 lb., 500 tons and over, f.o.t., £39 15s.; fishplates for rails 80 lb. and over, 50 tons and over, f.o.t., £53 11s.; soleplates, f.o.t., 100 tons and over, £51. Light flange rails, 25 lb. and under, d/d N.-E. Coast, Midland, Northern Joint, and South Wales Areas, and Central Scotland, 50 tons and over, £50 12s. 6d.; fishplates for light rails, 50 tons and over, £50 12s. 6d.

BLAST-FURNACE COKE

(F.O.T. at Ovens)

DURHAM AND NORTH-EAST COAST: 159s. 3d. SOUTH WALES: 158s. NOTTS AND DERBY: 135s. 5d. LANCASHIRE: 146s. STAFFORDSHIRE: 139s. 5d. YORKSHIRE: 138s. 8d. SCOTLAND: 169s. 4d.

(All prices are subject to quality differentials.)

STEELWORKS SCRAP

(Plus 5 per cent. in the case of sales by merchants.)

	Scotland.	N.-E. Coast.	Midlands.	Sheffield.	Lancs.	S. Wales (East)	S. Wales (West)
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Heavy steel scrap* ..	229 3	228 3	220 0	226 3	226 3	227 3	232 3
Heavy mixed scrap* ..	207 3	206 3	198 6	204 3	203 9	205 3	210 3
Heavy steel turnings† ..	179 9	179 9	169 9	176 9	174 3	177 0	180 0
Heavy cast iron†	206 9	203 9	208 0	204 3	189 3	199 3	205 9
Cast-iron borings†	160 3	157 3	157 0	159 9	157 3	159 6	164 6

* Basis 500-ton lots in England and Wales and 250 tons and upwards in Scotland, delivered.

† Not less than 250 tons in England and Wales, 100 tons in Scotland.